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A

TREATISE ON INSECTS.

A

TREATISE ON INSECTS

INJURIOUS TO

GARDENERS, FORESTERS, & FARMERS.

BY VINCENT KÖLLAR,

CURATOR OF THE ROYAL CABINET OF NATURAL HISTORY AT VIENNA, AND MEMBER OF
MANY LEARNED SOCIETIES.

TRANSLATED FROM THE GERMAN, AND ILLUSTRATED BY ENGRAVINGS,

BY J. AND M. LOUDON.

With Notes,

BY J. O. WESTWOOD, ESQ., F.L.S. &c.,

SECRETARY TO THE ENTOMOLOGICAL SOCIETY.

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TO

A. B. LAMBERT, ESQ. F.R.S.

ETC. ETC. ETC.

WHOSE NAME IS SO WELL KNOWN TO ALL LOVERS OF

NATURAL HISTORY,

AS A WARM FRIEND AND PATRON OF EVERYTHING RELATING TO THAT SCIENCE,

This Volume

IS

(WITH PERMISSION)

MOST RESPECTFULLY DEDICATED BY HIS OBLIGED AND OBEDIENT SERVANTS,

JANE AND MARY LOUDON.

M. KÖLLAR'S PREFACE.

The farmers, foresters, and gardeners of Austria having at certain seasons suffered severely by the devastations of insects, and being ignorant not only of the means of preventing these devastations, but even of those necessary to be taken to destroy the insects while in the act of ravaging the crops, the Royal and Imperial Agricultural Society of Vienna resolved to publish a popular Natural History of all the insects injurious to vegetation.

His late majesty, the Emperor Francis I., not only expressly authorised this useful undertaking, but commanded its speedy execution; on which account the standing committee of the Society commissioned three of its members, viz. Charles Baron Binder von Kriegelstein, Roy. Imp. Forest-counsellor; the Canon Regular of the convent of St. Floriace, M. Joseph Schmidberger, and myself, to undertake the execution of the intended work in such manner as they should agree upon.

Baron Binder von Kriegelstein, being prevented by numerous affairs connected with his profession, was unfortunately unable to find time to reduce to writing his extensive and fundamental knowledge of forest-entomology, which department was allotted to him; but he has communicated much valuable information, and has directed attention to the injuries committed by various kinds of insects in the forests committed to his care.

Canon Schmidberger undertook to write on the insects injurious to fruit-trees, and his papers, founded on many years' observation and experience, have been inserted with his name.

The papers on the insects injurious to the other branches of rural economy, as well as the superintendence of the work itself, the standing committee entrusted to me.

After the plan of the work was formed, many deficiencies became apparent which were still to be supplied; and notwithstanding the previous labours of various naturalists and agriculturists which were before me for my use, these difficulties appeared so numerous, that I should scarcely have had courage to proceed, if the indulgent encouragement of the Society, as well as the hope of doing good, by adding, in however trifling a degree, to the general stock of knowledge, had not spurred me on afresh. It also appeared to me that the only means of encouraging the practical farmer, forester, and gardener, to co-operate with me in future, by making observations on insects generally, was to show them how much was yet to be done in this branch of natural history and agriculture.

Although in the following pages the most important enemies of the agriculturist are enumerated; their development, manner of life, and relation to vegetable productions explained as far as possible; their enemies pointed out; and the means of destroying them, according to all these considerations, discussed and explained; yet expectation must not be raised too high; and it must not be supposed that in order to arrest the inroads of every kind of caterpillar, or to prevent the injury caused by every beetle or fly, a particular and approved remedy is given; or, that this book contains a number of such recipes. The principal point which has been attained, is an exact knowledge of the enemy in every ascertainable state and situation; and to spread this knowledge was the principal aim of myself and my colleagues, as the means of destroying the insects or preventing their reappearance must be founded upon this knowledge.

To enable the readers, for whom this book is intended, to find more easily the insect particularly interesting to each, it has been considered proper not to treat of families and species in any systematic arrangement, but according to the branch of culture to which they are particularly injurious.

To render the work more complete to the farmer, I thought it fit not to pass over in silence the insects troublesome and injurious to sheep and cattle. It also appeared necessary to me, in order to pave the way for the unlearned, who in future might wish to pursue the study of entomology more scientifically, to give a slight general idea of the system of insects, of their transformation, manner of life, uses, &c. In doing this, I have never entered into the subtleties of the new systematists, having always kept in view my principal aim of treating the subject in as comprehensible a manner as possible. Bechstein's "*Forst-Insectologie*," newly revised by Dr. D. E. Müller, served me as a model for many of these chapters.

Several members of the society, as well as other naturalists and rural economists, have contributed to enrich this little work, partly by verbal, and partly by written, communications; for which I return them my most grateful thanks, and invite them to take a further interest in this generally useful undertaking, to which additions will be from time to time introduced into the transactions of the Royal and Imperial Agricultural Society.

VINCENT KÖLLAR.

Vienna, May 20*th*, 1837.

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[In the original were two sections, one on the body insects which annoy man, and the other on the domestic insects found in dwelling-houses, which have been omitted by the translators.]

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8

INTRODUCTION.

ON THE ADVANTAGES OF STUDYING ENTOMOLOGY BY THE AGRICULTURIST AND FORESTER, AND ON THE METHOD OF DOING SO.

THE branch of Natural History which respects the knowledge of Insects is named, according to the generally received Greek expression, Entomology.

The intimate connexion in which insects stand to man, to domestic animals, and to the different kinds of vegetable productions, makes them well worthy the consideration of every one, and particularly of the agriculturist and the forester. Although insects are small and inconsiderable, the exceedingly great number of species, and the still greater number of individuals in many of them, fully compensate for their want of corporeal magnitude. The amount of the species of plants, and all the classes of other animals taken together, cannot (according to the latest estimates) equal in amount the species of insects, as we reckon about 300,000 species. If we consider the fecundity of many kinds of insects, which sometimes produce an offspring of several hundreds, or even thousands (the females of the termites, or white ant, producing an offspring of 40,000,) and also that some kinds produce several generations in one year, it appears evident that the number of insects can hardly be estimated. As a proof of this, which perhaps to many may appear too bold an assertion, we need only mention the enormous swarms of locusts, which are sometimes so numerous, and in such masses, that they darken the sun, and when they alight, they frequently cover several square miles of land; also the *Rhagio Columbaschensis* Fab., a minute dipterous insect, but a fearful plague in many parts of the bannat of Temeswar, and which when congregated in the air resemble dark clouds, although each individual is not more than two lines long. Who could even reckon the myriads of gnats or midges, which in many years, like pillars of smoke, ascend in the air? Or who could succeed in ascertaining the number of inhabitants in an ant-hill? All these myriads derive their nourishment either from plants or animals, in their living state, or from their remains when dead; and there are even some to which man himself must pay tribute with his blood.

"From such considerations are we not" (says Schrank, the worthy Bavarian naturalist,) "alarmed for our forests, gardens, and groves? Do not these innumerable millions of insects which incessantly labour at their destruction, confuse our understanding when we begin to reckon them, and terrify our imagination which magnifies them? And can I be believed if I assert, that I discover beneficence in such unspeakable destruction, beauty in these devastations, wisdom in this disorder, and life in this manifold death? Nevertheless it is so. Whatever many may say of nature growing old, the naturalist finds her always young and beautiful, always estimable, just as she came from the hand of her

Creator, and as she indeed every moment issues afresh from the hand of the Almighty Being. In His hand the youth of nature is continually renewed; and under His all-ruling providence, all the millions of apparently destructive beings only labour in preserving her existence and embellishment.

"Let us here contemplate the whole economy of nature at a general glance, in respect to forests only; and let us view her as she is, without the aid of man, who often disturbs her general arrangement.

"Insects that feed on wood are not injurious to ligneous plants, except from their disproportionate numbers; and these numbers, when left to bountiful nature herself, are never disproportionate: two assertions which, however paradoxical they may seem at first sight, are yet admitted by the naturalist, who has proofs of them daily before his eyes, as principles, but which I must here demonstrate, because many persons who are engaged in studying the works of nature, either as professional men, or as amateurs, are not naturalists.

"In a work on the Fruitfulness of Plants [also written by Schrank] it is stated that an elm twelve years old in one single year produces 164,500 seeds; which in the course of another twelve years, (if no accident happened) would become as large trees as their parent: and from this calculation it appears that a succession of much more than 26,960 millions of trees might be obtained from one.

"This calculation is made from the fruit only, and not from the blossoms of any tree, and is, therefore, applicable to all other trees. A single species of tree, such as we have them in one of our provinces the most scantily clothed with trees, would during the life of man cover a large extent of land with a thick forest, and after a few centuries it would appear as if the whole world had been made for it only—as if it alone would cover the whole extent of dry land.

" The great multiplicity of organised beings which makes the world as it is at present so beautiful, would then have disappeared; symmetry, which gives a charm to this multiplicity, and which delights the contemplator of nature in exalted enthusiasm, would have vanished; soon would all animal life in the habitable world be destroyed; a great number of birds which live only on insects which eat wood, we have already annihilated, by our presupposition that these insects do not exist; the thick impenetrable forest, which the kind of tree mentioned would cover, would soon supplant every blade of grass, kill every insect intended to live upon it, every bird to which these insects were intended as food, destroy all animals living upon grass that could not reach the tops of the high forest trees, and finally kill every beast of prey, which could not at last even find a carcase to satisfy its ravenous hunger.

" This is but too faint a picture of our earth, which without the insects that live on wood, would be but too true. A wise hand has scattered them everywhere, and given to each kind its particular instinct, its peculiar economy, and great fecundity. With them, order and life are restored to universal nature. On their side, pursued by powerful, or weak, but not less numerous enemies, they unceasingly follow the given commands of Providence.

" The proportion which exists between their increase and the occasion for it, and their enemies, secures nature from the devastations which they would occasion, and restores all to the most admirable equality.

"A forest of firs more than a hundred years old, has already nearly terminated its appointed existence. A host of caterpillars first takes possession of the branches, and consumes the foliage. A superfluity of sap, (the circulation of which is rendered languid by the failing strength of the tree), an unnatural increase of the nourishing juices between the bark and the wood, and the separation of these parts, are the consequences.

"Another host of insects now appears; they bore through the rind into the inner bark, which they eat, and pierce through; or into the wood, which they pierce and destroy. The diseased trees are now nearly dead; the numerous destructive insects increase with the sickness which attracted them there; each tree dies of a thousand wounds, which it receives externally, and from the enervation which follows in consequence. The dissolution is accomplished by a third host of, for the most part, smaller insects, but still more numerous; and these are continually employed in reducing the decayed trunks to dust as soon as possible, while at the same time a thicker forest of young trees, and generally of a different kind, spring out of the earth, which had afforded nourishment to the dead tree. The first host certainly occasioned the deathly sickness of the forest; the second accelerated its death; and the third accomplished its total destruction. It need not be lamented. These trees would have died a few years later, without any utility resulting from their death. Their leafless stems would probably have remained there for half a century awaiting their destruction, of no use where they stood, and serving no purpose but as a fearful trophy of death in the field of life. They must die, because they are organic matter. But we only destroy a worn-out vessel, that a better may take its place, but are not able to make anything better out of it. It is not so with nature. Millions of sensitive beings find a use in the remains of these dying trees, and under every step of near and approaching death thousands spring forth endowed with vitality.

"Each host of these insects are again exposed to destroyers, which put a check to their too great extension. Other insects, and a great number of birds, clear away the caterpillars while they are feeding on the leaves, and when they have undergone their change, and are lying in the earth, the wild boar comes and stirs them out from their place of rest with his tusks, and devours them with the greatest eagerness. Those insects which conceal themselves in the inner bark or wood do not share a better fate. The woodpecker knows where to find them, and draws them out of the deepest holes. When they appear on the bark in the perfect state, they have the bitterest enemies in the flycatcher, the tree-creeper, and all kinds of magpies. Whole hosts of these birds are found where these insects abound in multitudes; but they leave the place and disperse themselves as soon as the superfluity of nourishment is exhausted*. In this state all nature is on a perfect equality;

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* Not only does this abundant prevalence, in proportion to the numbers of insects which constitute their food, occur in the feathered tribes, but it has also been observed in the parasitic and insectivorous insects, and that not merely as a more numerous congregation, but as an actual increase of numbers. Thus it has been observed, that when the processionary caterpillars are especially abundant, the brilliant beetle *Calosoma sycophanta*, which feeds upon them in the perfect state, is produced in equal proportion. The causes which operate in the production of a more than ordinarily numerous supply of the injurious insects, seem equally favourable to the increased development of their enemies.

but man comes, and destroys the order—he annihilates the harmony of nature, and is astonished at the discordance. First, he sacrifices the wild boar to gratify his palate; takes possession of the wood, and, according to the usual fallacy of taking the consequences for the cause, considers the woodpecker his enemy, and finally, under various pretences, wages war with all the birds of the forest*. Insects appear to him too contemptible for his pursuit, too small, too numerous, and too well concealed, to reward him directly for the trouble of endeavouring to extirpate them. They may, therefore, go on with their occupations undisturbed, and if they carry them too far, he then complains of Providence.

"After having wrested the lordship of the woods from the animals, we should pursue with wisdom the economy which heretofore the animals, from a blind impulse of nature, had practised. We should anticipate nature in her operations, and cut down trees that approach weak old age, or those that are checked in their growth by a stronger tree standing near them, or those that have been killed by lightning; and the teeth of the boar which prepared the earth for the seeds, should be replaced by the pickaxe, and our tame pigs ought to be employed in digging up the earth-grubs, which the boar was accustomed to do. We only are to blame if our finest forests are destroyed," &c.—Such are the expressions of a practical naturalist on insects which are injurious to forests. A similar picture may be formed of those which attack fruit-trees, field fruits of all kinds, and even our domestic animals.

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* A most characteristic anecdote, in illustration of this observation, is given by Mr. Spence in the Introduction to Entomology, respecting the rook, v. i. p. 31.

The result of such contemplations will be, that we can only protect ourselves from the injurious influence of insects by an ample knowledge of the reciprocal relation in which one stands to another, and in order to obtain this, it is essentially necessary to acquire a knowledge of those kinds which are directly or indirectly injurious to man, their different stages of life, their nourishment, propagation, duration, and finally their natural enemies.

From what has been said, the importance of the subject which will be treated of in the following pages, is sufficiently clear.

A TREATISE

ON THE

INSECTS INJURIOUS TO VEGETATION, &c.

I.—SKETCH OF INSECTS AND THEIR CLASSIFICATION.

INSECTS are animals which have a body consisting of one or more divisions, articulated feet, a head conspicuously distinct from the body, on which are placed two movable horns, called antennæ. They breathe through air-holes, which are situated on the sides of the body; the greater number have wings in their perfect state, and only a proportionably small number are entirely without them. With the exception of certain groups, all insects have six feet, and their bodies are divided into a head, thorax, and abdomen, by notches or incisions; hence the name *insect* is derived from the Latin word *insecare*, to cut or notch. Before they attain their perfect state they are subject to various transformations, which are called metamorphoses.

For the sake of perspicuity the very numerous class of insects, the most extensive in the whole animal kingdom, has been divided into two principal divisions—the winged, and the wingless. Winged insects are further divided into the following orders*:

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* The arrangement of the winged orders of insects here given is that proposed by Latreille; other arrangements, founded primarily on the mandibulated or suctorial form of the mouth, have been adopted by other celebrated Entomologists; and some of the tribes introduced by Latreille into the orders given in the text, have been constituted into distinct orders by Leach, Kirby, and others, as, for instance, the Earwig forming the order *Dermaptera*, the Cockroach that of *Dictyoptera*, the Caddice-flies (*Phryganea*) that of *Trichoptera*, &c.

1.— Coleoptera, (*Beetles; Käfer, Scheibenflügler*[*],) with six feet, and mostly with four wings, the anterior pair of which are horny, in the form of a covering for the two posterior wings, which are sometimes wanting. They have upper and lower jaws (mandibles and maxillæ) for gnawing or chewing: their under wings are transversely folded. Examples—the may-bug, the long-horns (*Cerambycidæ*), stag-beetles, ground-beetles (*Carabidæ*), and weevils.

2.—Orthoptera, (*Gradflügler*): six feet, four wings, the two anterior of a leathery substance, serving as covers to the posterior, which are folded both longitudinally and transversely, but more generally only longitudinally, (whence the name *gradflügler*,) and which only lie when at rest concealed under the others. They have upper and lower jaws, (or mandibles and maxillæ) for chewing. Examples—the black-beetle, the cockroach, the field-cricket, the migratory locust, and the green grasshopper.

3.—Hemiptera, (*Halbflügler*). Six feet, four wings, the two anterior forming hard coverings with membranous ends, or resembling the lower ones, but being larger and stronger. Instead of upper and lower jaws, the organs of the mouth are formed of bristles, which compose a sucker, and which is inclosed in an articulated sheath, consisting of one piece, of a cylindrical or conical shape, and forming a projecting beak. Examples—the field and tree bugs, house bugs, Cicadæ, and Aphides.

4. Neuroptera, (*Netzflügler.*) Six feet, four membranous naked wings, upper and lower mandibles for chewing; the wings are delicately veined, the under nearly the size of the upper, or even longer in diameter. Examples—the dragon-fly, or *libellula;* lace-fly, or *hemerobius;* and day-fly, or *ephemera.*

5.—Hymenoptera, (*Hautflügler.*) Six feet, four membranous wings, upper and lower jaws; the posterior wings smaller than the upper. In the abdomen of the female of most species is a sting, or ovipositor. Examples—the saw-flies (*tenthredinidæ*), *Sirex gigas*, gall-fly, bees, wasps, humble-bees, and ants.

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[*] We have not attempted to translate the German names by which the orders of insects are known in ordinary conversation; as it would hardly suit the genius of our language to style, for example, the Neuropterous insects, Net-wingers, or the Diptera two-wingers.

6.—LEPIDOPTERA, (*Staubflügler*, *Schmetterlinge.*) Six feet, four membranous wings, covered with small, coloured, mealy shining scales or feathers. Instead of the upper and lower mandibles, two hollow filaments exist, which together form a spirally rolled tongue. Examples—butterflies, moths, and hawk-moths.

7.—RHIPIPTERA, (*Fächerflügler.*) Six feet, two membranous wings, folded like a fan; on the anterior part of the thorax are situated two small bent hard movable bodies, like wing covers. The masticatory organs consist of simple bristle-shaped mandibles, and two palpi. To this order belong two genera of parasites living on wasps in Italy*.

8.—DIPTERA, (*Zweiflügler*). Six feet, two membranous expanded wings, generally with two movable organs, called poisers or balancers, (*Halteres*), and which are situated behind the wings. The organs of the mouth consist of a sucker formed of a variable number of bristles, which are enclosed in an unarticulated sheath; most commonly they have a real proboscis, which terminates in a double lip. Examples—gnats, midges, house-flies, ox and horse-breeze flies, &c.

Insects without wings consist of the following orders:—

9.—MYRIAPODA, (*Tausend füsse*, *Millepedes*). They have more than six feet, twenty-four at least, and upwards, which are placed on a series of rings, extending the whole length of the body; each ring has generally two pairs. The first, and sometimes also the second pair, form parts of the mouth. Examples—the centipede, Julus, and Scolopendra.

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* The author does not appear to have been aware of the establishment of the two genera Elenchus and Halictophagus, in addition to those of Stylops and Xenos; neither does he seem to be acquainted with the fact that some genera of bees are infested by these parasites.

10.—Thysanura, (*Springschwanze.*) With six feet; on the under sides of thé abdomen are situated flat movable appendages like pro-legs, and at the extremity is a forked apparatus, by which the body can raise itself and move by leaps. Examples—the sugar-louse, (*Lepisma saccharinum.*)

11.—Parasita, (*Schmarozer*). Six feet; no other organs of sight except simple eyes; the mouth is mostly internal, and consists of a snout, which contains a retractile sucker, or it forms a cleft with two lips, two mandibles, and hooks. Examples—the different species of lice.

12.—Suctoria, (*Sauger*). Six feet, of which the posterior are the longest, and adapted for jumping; these undergo a transformation, and acquire organs of motion which they had not at first. The mouth consists of a sucker, which is enclosed in a cylindrical sheath, and is formed of two articulated pieces. Example—the flea*.

II.—TRANSFORMATION OF INSECTS.

The greater number of insects properly so called, with the exception of some without wings, change their form several times during their life in so striking a manner, that a person unacquainted with entomology would be inclined to consider one and the same insect, in different periods of its existence, as so many entirely different animals.

To the farmer, gardener, or forester, the knowledge of the transformation of insects is of the greatest importance, as without it he beholds his greatest enemies without having the means of defence or mode of attack, and neglects the most suitable opportunity for their greatest possible diminution, or entire extirpation, from the want of knowledge.

Insects, in general, are produced from eggs; a few species alone, in which the eggs are developed in the body of the mother, are viviparous; for example, the aphis.

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* Crabs and spiders, which Linnæus included among insects without wings, are now formed into two distinct classes—Crustacea and Arachnida.

The female lays her eggs, which are often stuck on and covered with a sort of glue, to preserve them from the weather, shortly after pairing, instinctively in the place best adapted to their development, and which offers the proper food to the forthcoming brood. The white-thorn butterfly and the golden-tail moth, lay their eggs on the leaves of fruit-trees or other leafy trees, and the latter covers them over with a gold-coloured covering of silk. The common lackey-moth (*Gastropacha* (*Bombyx*) *neustria*) fastens them in the form of a ring round the stem of the fruit-trees; and the gipsy-moth (*Bombyx dispar*) fastens them in a broad patch on the stem of the tree or paling, and covers them with a thick coating of hair. The winter-moth (*Geometra brumata*) lays them singly on the buds of the leaves and flowers; the printer-beetle (*Bostrichus typographus*) introduces them between the bark and the albumen, &c.

Most insects are developed from the eggs in the shape of worms, which are called larvæ. The larvæ of butterflies, which are always provided with feet, are called caterpillars, those of beetles and other insects, larvæ; and when they have no feet, the latter are called grubs or maggots.

In this state, as their bodies increase, the insects often cast their skin, and not unfrequently change their colour. Many winged insects—(*e. g.* cimex, cicada, grasshoppers, and dragon-flies)—in their larva state, very much resemble the perfect insect; they only want the wings, which are not developed till after the last change of the skin. The larva state is the period of feeding, and at this period insects are usually the destructive enemies of other productions of nature, and objects of persecution to farmers, gardeners, and foresters.

The nympha or pupa state succeeds that of larva. In this state insects for the most part take no nourishment (with the exception of grasshoppers, cimices and cicadæ, which, as has already been stated, vary but little in form from the larva), and repose in a death-like slumber. Their body is covered with a skin more or less transparent, through which the limbs of the perfect insect are, more or less, apparent. To be safe from their enemies, or from the weather, the larvæ of many insects, particularly butterflies, prepare for themselves a covering of a silky or cottony texture; many form themselves a house of earth, moss, leaves, grass, haulm, or foliage; many even go into the earth, or decayed wood, or conceal themselves under the bark of trees, &c.

After a certain period, which is fixed in every species of insects, and which can either be hastened or retarded according to circumstances, the perfect insect appears from the pupa. It is usually furnished in this state with other organs for the performance of its appointed functions. It is incumbent on the perfect insect to propagate its species, therefore the organs for this purpose are only perfected at this period of their lives. The male insect seeks the female, and the female the most suitable place for laying her eggs; hence most insects are furnished with wings.

Food is now a secondary consideration, consequently in many the feeding organs are now less perfectly developed than in the larva state, or very much modified and suited for finer food, as for example in butterflies, which, instead of the leaves of plants, only consume the honey out of their flowers.

III.—ON THE FOOD OF INSECTS.

Insects, like other animals, derive their nourishment from the vegetable and animal kingdoms; but a glance is sufficient to show, that they possess a much wider field of operations than the others.

While the other animals make use for their subsistence of only a small portion of the inexhaustible treasures of the vegetable kingdom, and reject the rest as insipid or noxious, the insects leave perhaps no vegetable production untouched. From the majestic oak to the invisible fungus, or the insignificant wall-moss, the whole race of plants is a stupendous meal, to which the insects sit down as guests. Even those plants which are highly poisonous and nauseating to other animals, are not refused by them.

But this is not yet all. The larger plant-consuming animals are usually limited to leaves, seed, and stalks: not so insects, to the various families of which every part of a plant yields suitable provender. Some, which live under the earth, attack roots; others choose the stem and branches, a third division live on the leaves, a fourth prefers the flowers, while a fifth selects the fruit or seed.

Even here a still further selection takes place. Of those which feed on the roots, stem, and branches, some species only eat the rind, like the bee-hawk-moth, (*Sphinx apiformis*), others the inner bark (*bast*), and the alburnum, like the *Tortrix Woeberiana*, and the injurious bark-beetle; a third division penetrates into the heart of the solid wood, like the goat-moth, (*Cossus ligniperda*), and the family of the long-horned beetles, (*Cerambycidæ*).

Of those which prefer foliage, some take nothing but the juice out of the veins (aphides, in all their states); others devour only the substance of the leaves, without touching the epidermis (*mining caterpillars*); others only the upper or under surface of the leaves, (many leaf-rollers, *Tortrices*); while a fourth division devour the whole substance of the leaf (the larvæ of *Lepidopterous* insects).

Of those which feed on flowers, there are some which eat the petals, (*Noctua verbasci*, the mullein-moth, and *N. linariæ*); others choose the farina in a perfect state, (bees, the rose-chaffer (*Cetonia*) the *Lepturidæ*, &c. &c.); and a still greater number the honey from the nectaries, (most *Lepidopterous* insects, wasps, and flies). There are also insects, which not satisfied with any existing part of the plants, as such, cause injury to one part or another, by occasioning a peculiar body or excrescence, in which their young live, as the various sorts of gall-insects and other sorts of flies.

But insects are not confined to plants alone in their living and unused state. The death-watch, or ticking-beetle, (*Anobium*), feeds on wood which for years has been used in our dwellings, and in various articles of furniture and utensils.

From what has been said it will appear, that a single plant can support a host of various sorts of insects on its different parts; whence it also appears, that the number of insects greatly exceeds that of plants.

An equal variety in the food of those insects which live on animal matter may also be pointed out. Some live as parasites on the skin of other animals, not excepting even insects themselves, suck their blood, and are a burdensome torment to the animals; to these belong the different sorts of lice (bird and sheep lice), ticks and mites. Others attack the larger animals only for a short time, and draw blood—gnats, midges, autumn-flies, breeze-flies, bugs, and fleas. Some breeze-flies (*Œstridæ*) penetrate through the skin into the flesh of the red deer and horned cattle; others live in the stomachs of horses and asses, and one sort in the frontal sinus of sheep. The Ichneumonidæ feed on the flesh of the larvæ of other insects, and often greatly contribute to the extirpation of noxious insects.

The *Carabidæ* and other carnivorous beetles devour their prey entire, immediately after killing it; while the *Cimices* and *Hemerobii* only suck out the juices. The larvæ of the stinging-gnat and other flies which live in water, devour whole swarms of infusoria alone. A great number live on carrion and the excrements of animals, and thus diminish and destroy the corruption proceeding from such matter; to these belong chiefly the blue-bottle fly, horse-beetle, carcase-beetle, and dung-beetle.

Many feed upon prepared animal matter, and become very prejudicial to household economy. Many moths live entirely on hair, leather, wool, and feathers.

With the various transformations of insects, their economy is also changed, and consequently their abode is also varied; the caterpillar requires very different food from the butterfly; the maggot from the beetle and fly. The larva of *Sirex gigas* feeds on wood, while the perfect insect preys on flies. The larva of the may-bug or cockchaffer lives on roots and tubers, the beetle on leaves.

Many insects are very gluttonous, and often consume more food in a day than is equal to the weight of their bodies. Thus the maggot of the flesh-fly, according to Redi, becomes 200 times heavier in the course of twenty-four hours. Caterpillars digest in one day from one-third to one-fourth of their weight; and hence it is apparent that a comparatively small number of caterpillars can entirely strip a tree in a few days.

Opposed to this gluttony of caterpillars, some insects in their perfect state appear to take no nourishment, such as the day-flies (*Ephemeridæ*), and the breeze-flies (*Œstridæ*); the latter of which, in their larva state as maggots, feed on the flesh of horned cattle and red deer.

Even among the *Lepidoptera*, many of those which spin cocoons, especially *Bombycidæ*, seem to take no nourishment.

Many insects only eat in the day, others in the evening, and a third division, such as the caterpillars of the night moths, only in the night. Most of them seek their own food; but a few, namely, the larvæ of bees which live in communities, humble-bees, wasps, and ants, are fed by the perfect insect. Many stow away their food; others, indeed the greater number, live without making any previous supply of food. The larvæ of the caterpillar-killing kinds of wasps (*Sphegidæ*), of wild bees, and of a few other insects, are provided by their parents with provisions sufficient for their nourishment in the larva state.

IV.—DISTRIBUTION AND HABITAT OF INSECTS.

THE distribution of insects is in exact proportion to the diffusion of plants; the richer any country is in plants, the richer it is also in insects. The polar regions, which produce but few plants, have also but few insects; whereas the luxuriant vegetation of the tropical countries feeds a numerous host of insects.

With respect to their habitation, insects are divided into those which live upon land or water.

Those which live in the water, either never leave that element, or are able at live at will, either in the water or on the earth, at least for a short time; for example, many water-beetles. Many live at certain periods of their development in water; at others, on land; such as many sorts of flies, and all the dragon-flies, which as larvæ and pupæ live in water, but as perfect insects on land, or in the air.

Land insects live either in the earth, under stones, in decayed wood, or in putrid animal substances. Of these some pass their whole lives in these places, others only during a particular period of their development. The larvæ of the dung-beetle live deep under the ground, while the perfect insect inhabits the excrement of animals; many of the larvæ of flies live in carrion or excrement, while the perfect insect flies about in the open air. A very great number choose the different parts of plants for their abode, as the roots, bark, inner bark, alburnum, wood, pith, buds, flowers, leaves and fruit. They change their abode in every new stage of their development. Thus the bark-beetle, which in the larva state lived under the bark, swarms in its perfect state upon the trees; the curculio of the apple-tree, the larva of which infests the bottom of the apple blossom, crawls on the trees, or on the surrounding ground; the mining-moth, which as a larva lives under the cuticle of the leaves, flutters in its winged state about the flowers and leaves.

A small number live upon other animals, on the skin, such as lice, or in the inside of the body, as the ox and horse breeze-flies (*Œstridæ*). The two latter leave their first abode before entering the pupa state, which they effect in the earth, and hover as flies round the animals to deposit their eggs upon them.

Most insects live solitarily, either without any definite dwelling, or they construct for themselves a house composed of various kinds of vegetable or animal matter; for example, many caterpillars. A few species live in society, such as bees, ants, wasps, &c.

By obtaining a general knowledge of the abode of insects, it is evident that the observer of the economy of insects will be able more satisfactorily to combat many that are injurious to him; thus he can, with little trouble, greatly diminish or entirely annihilate those which he has ascertained to live in society, or in places of easy access.

V.—USES OF INSECTS.

THAT insects, even such as appear to be injurious, cooperate beneficially in the great economy of nature to the preservation of an equilibrium, has already been sufficiently proved in the Introduction, by examples. There are among them no very inconsiderable number from which man derives, in many respects, immediate and important uses.

We will here only mention bees, which furnish us with wax and honey, without explaining their various applications in housekeeping and medicine. Who does not know the use of the silkworm, which furnishes occupation and food for so many thousands of mankind? The different sorts of gall-nuts, ingredients so essential to dyeing and the manufacture of leather, which are the productions of various sorts of insects, namely, the gall-flies, which wound with their ovipositor various parts of the oaks, in order to deposit their eggs in the cavity, and which produce these useful excrescences. The most durable and most beautiful red (cochineal), we owe to a small insect, the *Coccus cacti.* Another, nearly allied to the above-named insect, *Coccus manniparus*, saved the lives of the Israelites in their journey out of Egypt, for they would have died of hunger if they had not found manna, a sweet nutritive substance, which, in consequence of a wound caused by this insect on the Tamarix gallica mannifera, trickles on the ground*.

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* A figure of this interesting insect, and of the plant upon which it is found, has recently been published by Dr. Klug, in the *Symbolæ Physicæ*, a valuable work now in course of publication in Berlin, in which the animals collected by Hemprich and Ehrenberg in Arabia, are

The *Cantharides*, or Spanish blister-flies, are an essential article of medicine. Many insects accomplish the fructification of different plants. Whole nations in other quarters of the globe live on grasshoppers. Many mammalia, a number of birds, amphibious animals, and fishes, live entirely on insects.

A great number of these creatures even live upon other species of insects, and destroy them: thus preventing the hurtful from preponderating, and disturbing the balance in the economy of nature. To these belong chiefly the *Ichneumonidæ* and spiders.

Lastly, how many diseases are obviated, particularly in warm climates, by insects speedily consuming dead animal substances, and thereby preventing the generation of noxious gases!

The injury which many insects cause in the economy of nature, will appear in the discussion of the individual species.

VI.—MEANS OF DEFENCE AGAINST NOXIOUS INSECTS.

The means of defence against noxious insects are two-fold; first, those which nature employs to circumscribe the too great increase of certain insects; and secondly, those which human understanding can oppose to the evil arising from the superfluity of noxious insects.

1. Means contrived by nature to confine the devastations of insects.—Many appearances in nature, even

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described and figured. It is by these travellers' and authors' work that the *Coccus manniparus* was first made known. How far it is to be considered unquestionable that the material which exudes from the Tamarix at the present day by the puncture of the Coccus, is identical with the manna by which the Israelites were fed during their travels in the Desert, as recorded in the Bible, must be matter of speculation; it is certain, however, that some of the particulars detailed in the Bible, and especially those of a miraculous nature, are not exhibited by the manna now collected in Arabia and upon Mount Sinai.

such as at first cause anxiety and care, on account of their injurious consequences, are found to be in many respects highly beneficial and salutary, although we may not always understand them. Thus, continued rain, which in many respects is extremely hurtful, contributes greatly to diminish the number of noxious insects, and for a series of years renders them entirely innocuous. This continued rain may, for example, take place at the pairing time of certain insects, which will greatly obstruct them ; or at the time when the insects are in the caterpillar or larva state, when thousands die in consequence of bad weather, and our fields, orchards, and woods, are cleared of a dangerous enemy for many years.

Thus in the spring of 1832, after incessant rain, I saw the caterpillars of the white-thorn butterfly (*Papilio cratægi*,) which for many years had not only stripped all the hedges, but also done considerable injury to the fruit-trees, dying by thousands, as if of a dropsy. The caterpillars swelled, became weak, and died. If they did attain the pupa state, they suffered from the same evil, and the perfect insect was very rarely developed, on which account our gardens in the following years were entirely spared.

Late frosts are also very beneficial, as they entirely destroy many insects in their larva state. I had an opportunity early in the summer of 1833, of observing great devastations on the fir-trees in the neighbourhood of Vienna, by a species of saw-fly, (*Tenthredo rufa*, Klug.) The larva of this insect had attacked certain parts of a young forest of Scotch fir, and the question was how their ravages were to be prevented from increasing next year. Fortunately in the month of May, a moderate frost set in, and thousands of these larvæ were seen hanging to the twigs, as if scorched. In this manner their increase was limited for the future.

A multitude of insects are also destroyed by inundations, particularly such as undergo their transformations in the earth, or live upon it in all their stages, more especially if the inundation happens when they are near their final transformation. In meadows the different species of May-bugs (*Melolonthidæ*) suffer by this means; in kitchen gardens the mole-cricket; in orchards the pupa of the small winter-moth (*Geometra brumata*), when the water overflows the gardens late in the autumn, at the time when the moth is usually developed from the pupa lying in the earth.

Besides the means of preserving an equilibrium by storms, and the effects of the elements, nature employs a multitude of others, although not so speedy and efficient, to the same end.

To these belong the enemies of the destructive insects which we meet with in all classes of the animal kingdom. Among the mammiferous animals the bats hold a conspicuous place for their destruction of insects. We only see them flying about in the twilight, precisely at the time when many moths leave their hiding-places, and hover round the flowers. As they live almost entirely on insects, they no doubt devour great numbers of the hurtful sorts. And perhaps it is to be ascribed to this circumstance that fruit-trees standing near houses, churches, barns, &c. suffer less from insects than isolated trees. They do not confine themselves to moths, but eat beetles which fly about in the evening; among others, some weevils, injurious to the flowers and buds of fruit-trees, as the *curculio* (*Anthonomus*) *pomorum*, and *pyri*. These creatures, as they do no injury, should, therefore, be carefully preserved.

To the insectivorous mammalia also belong various sorts of mice, the mole, badger, hedgehog, squirrel, fox, and wild swine. Whether the benefits derived from them in this way counterbalance the mischief which many of these creatures cause, it is difficult to determine. At all events the squirrel and the hedgehog deserve to be spared.

Birds contribute much more than the mammiferous animals to the destruction of injurious insects.

Many caterpillars know instinctively how to conceal themselves from the birds which prey on them; in many their covering of stiff hair acts as a protection against their enemies. Others remain all day between rolled-up or flatly united leaves, and only go out to feed at night. Others find sufficient protection in the buds, into which they soon penetrate. Gregarious caterpillars live while they are changing their skin, and when they are going into the pupa state, in webs, in which they are inaccessible to birds. Others live under the bark of trees, and even deep in the wood.

Notwithstanding these and other obstacles, a great number are yearly devoured by the birds, particularly during the breeding season. In winter a multitude of birds, driven by hunger into the villages, diligently search the branches of trees for the eggs of many sorts of moths that are glued to them, and which yield a scanty sustenance to these frugal animals. Réaumur states that the green-finch tears open the strong nest of the yellow-tail moth (*Bombyx chrysorrhœa*), and consumes the infant caterpillars.

Among the birds of the woodpecker race, the green and red woodpeckers (*Picus viridis* and *major*), the nut-hatch (*Sitta cæsia*), and the tree-creeper (*Certhia familiaris*), may be considered the most useful. Although these birds seek beetles chiefly, and consequently contribute to the diminution of the long-horned and weevil tribes of beetles, they also consume a number of caterpillars.

Among birds of the sparrow tribe, the starling deserves particular mention. It lives in summer chiefly in pastures, but comes in spring and autumn in great flocks to the meadows and orchards, where it devours a great number of insects, pupæ, and larvæ. The chaffinch is a determined consumer of caterpillars and moths' eggs. The titmice are particularly useful, viz. — the ox-eye, and tom-tit, then the goldfinch, redbreast, and red-start, and also the wagtails.

The cuckoo also particularly deserves to be spared; it not only devours many of the smaller smooth-skinned larvæ, but even consumes the hairy caterpillars of many moths, particularly of the *Bombycidæ*. On examining the intestines of a cuckoo, in the month of September, I found therein, besides the remains of various insects, a great quantity of the skins of the caterpillar of the large *Bombyx piri*, which is acknowledged to be one of the largest European species, and has very stiff hair. The inner coat of the stomach was entirely covered with hair, but a close inspection with the magnifying-glass showed that the hair was not the hair of the stomach of the cuckoo, as some ornithologists suppose, but only the hair of the caterpillars. It may therefore be of very essential service when there is a superfluity of the caterpillars of the processionary moths (*Bombyx processionea*).

It is sufficiently known that great service is rendered by the whole race of crows to meadows and fields. Their favourite food is the larvæ of the cockchaffer, which are thrown up by the plough, and which they also draw out of the earth with their strong beaks.

It is a wonderful provision of nature that exactly at the time that the insects, injurious from their great numbers, appear, the greatest number of the insectivorous birds have hatched their broods, and their voracious young are ready to be fed upon them.

Insectivorous birds are also sometimes granivorous, and feast readily on our fruit, particularly cherries; but the injury they cause in this respect is not to be compared to the use they are of in destroying insects. At least we never hear of universal devastation caused by birds, though we do by insects.

From what has been said, it will be sufficiently clear how strongly it should be inculcated by the authorities to forbid the capricious persecution of these useful birds, particularly in the breeding season.

Among amphibious animals, which destroy insects, lizards hold a conspicuous place. Grasshoppers are the favourite food of many species. Frogs and toads also devour many insects.

Besides mammalia, birds, and amphibious animals, nature, to restore the equilibrium among her creatures, and particularly to prevent the preponderance of some sorts of insects, makes use chiefly of insects themselves, namely those which feed upon others, and which by degrees obtain a superiority over those that are hurtful to us.

Thus many sorts of beetles, particularly of the family of ground-beetles (*Carabidæ*), destroy a multitude of the pupæ of moths lying in the earth. Many flies, allied to our house fly, but much larger, lay their eggs in living caterpillars and destroy them. But the most useful are the Ichneumonidæ. The females of this numerous family, 1300 species of which Professor Gravenhorst has described in Europe alone, lay their eggs entirely in the bodies of other insects.

The manner in which these Ichneumonidæ accomplish their work of destruction is highly curious and interesting. All the species are furnished at the end of the body with an ovipositor, composed of several bristles attached together, with which they pierce the larvæ of other insects, and introduce their eggs into the flesh of the wounded animals. In some this sting is longer than the whole body, sometimes more than an inch long, namely, in those species which seek the objects of their persecution in the interior of trees or wood that has been much and deeply perforated by the insects which reside within. They perceive, either by their sense of smelling or by their antennæ, that their prey is at hand, and introduce their eggs, not without difficulty, into the bodies of the larvæ living in the wood. Some attack caterpillars feeding openly on plants, others perforate the various excrescences, or gall-nuts, which also contain larvæ; there are even many species, scarcely visible to the naked eye, which lay their eggs in the eggs of other insects, such as butterflies, and thus anticipate their destruction.

The eggs are hatched within the body of the living insect, and the young parasites, in the most literal sense, fatten on the entrails of their prey. At last the wounded caterpillar sinks, the enemies escape through the skin, and become pupæ; or the caterpillar, notwithstanding its internal parasites, enters the pupa state, but instead of a butterfly, one or more Ichneumonidæ appear. To these wonderful animals we often owe the preservation of our orchards, woods, and grain.

Besides the above-mentioned Ichneumonidæ, ants, field or tree bugs, and many sorts of spiders, contribute greatly in extirpating various insects.

2. MEANS WHICH THE HUMAN UNDERSTANDING CAN OPPOSE TO THE DEVASTATIONS OF INSECTS. — Previous to taking any steps for the destruction of injurious insects, it is indispensably necessary that we should be perfectly acquainted with them and their economy, not only in their perfect state, but in all their different stages. For it might easily happen that we might destroy those most beneficial to our fruit and forest trees, and suffer their enemies to remain. I will give a single instance as an example. Entire heaps of small cocoons are seen on the bark of trees, often not larger than the eggs of many butterflies. The gardener or forester who does not know that these are the cocoons of the useful Ichneumonidæ, but considers them to be really the eggs of moths, rubs them off the tree, and thus annihilates his best friends. To people unacquainted with the economy of injurious insects, the choice of the means necessary for their destruction is perplexing. It is often impossible to take measures against the perfect insect, because it either withdraws itself from our observation, or lives in concealed corners, or only appears by night. We must, therefore, try to find where it lays its eggs, and whether anything can be effected against them. Many moths lay their eggs, in patches, in places easy of access, and in this case it costs us little trouble to destroy our enemies before they have done us any injury. I shall mention here the gipsy-moth (*Bombyx dispar*), which lays its eggs in large circular or oval spots on the bark of trees, or hedges, and covers them with a yellow wool. If we destroy these eggs, one heap of which often contains 300, in autumn or spring our fruit-trees will be secured from one of their most dangerous enemies *.

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* A most satisfactory proof of the superior advantages arising from hand labour in the destruction of insects, has recently been given by M. V. Audouin, who was charged by a commission of the Académie des Sciences, to investigate the habits of a small moth, whose larva is found to be exceedingly injurious in vineyards in France. During the month of August, women and children were employed during four days in collecting the patches of eggs upon the leaves, during which period 186,900 patches were collected, which was equal to the destruction of

It is equally easy to destroy in the egg the yellow-tail moth (*Bombyx chrysorrhœa*), which is no less injurious to our orchards. This moth lays its eggs on the leaves of the fruit trees in a long narrow heap, and covers them with gold-coloured hair, which makes them very conspicuous. Pulling off and destroying these leaves, secures the garden from another dangerous enemy.

The satin-moth (*Bombyx salicis*), which not only attacks willows, but poplars, which it prefers, and strips our avenues almost every year, is very difficult to be extirpated in the larva state, as it spreads singly all over the tree. But when we know that the female in the month of July has laid her eggs like mother-of-pearl spots, chiefly on the bark of the poplar, a few ordinary labourers with their knives might loosen these eggs from the bark and destroy them.

No effectual means can be taken against other insects except in their larva or pupa states, because they deposit their eggs singly, or in concealed places, or because it is difficult to distinguish them from the objects on which they are placed.

It is impossible to destroy the dreaded processionary caterpillar (*Bombyx processionea*) in the moth state, because it flies in the night. It is almost as difficult to destroy its eggs, from their similarity in colour to the oak bark, which prevents their being observed, and also from their being distributed all over the branches in small longish patches. The caterpillars, however, are gregarious, they sit in the day time on the stem or large branches, so that hundreds can be destroyed at a blow, by means of a wisp of straw, or a bundle of old rags. In the pupa state they are also easily destroyed, as they are usually found by hundreds in a nest, and hang like brown excrescences all over the trunk.

The most essential and necessary means to be opposed to the serious injuries caused by insects, consists in the uni-

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11,214,000 eggs. In twelve days from twenty to thirty workers destroyed 40,182,000 eggs, which would have been hatched in the course of twelve or fifteen days. The number of perfect insects destroyed in a previous experiment by an expensive process was only 30,000.—See *Loudon's Gardeners' Mag.* for November, 1837.

versal dissemination of the knowledge of the natural history of hurtful insects among farmers, gardeners, foresters, and particularly among those who are in any way connected with agriculture. This knowledge should be spread as well by verbal expositions in public institutions, as by books easy of comprehension.

SECTION I.

INSECTS WHICH DO NOT USUALLY LIVE ON THE HUMAN BODY, BUT ARE OCCASIONALLY TROUBLESOME FROM THEIR ATTACKS ON MAN.

Among the great multitude of insects there are, with the exception of the well-known and disgusting tribes of lice, fleas, and bugs, only a few which are directly injurious to man, from their attacks. In order to give us a clear view of these few species, it will be best to go through each order separately, and point out our enemies.

1.—In the order of beetles (*Coleoptera*), the most numerous among insects, there are extremely few from the attacks of which man has anything to fear; very few of them, terrific as they may appear, are furnished with offensive weapons. It is generally an acrid juice which they employ as a means of defence, and which they emit on being attacked. This liquid is found more especially in many species of the family of ground-beetles (*Carabidæ*). These are mostly large insects, which live in the earth, under fallen leaves, grass, or stones, and in rotten wood. On one of these insects being caught, it discharges a stream of acrid, fœtid liquid, towards us, and generally so adroitly as to hit the face. This fluid causes violent burning on the tender skin of the face, but when it comes into the eyes it causes a burning pain, and not unfrequently inflammation. The most simple and safest means to allay the pain, and subdue the inflammation, is cold water, which dilutes and washes off the liquid.

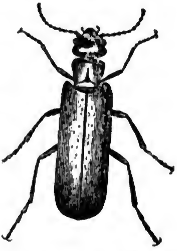
Some species of ground-beetles eject, instead of liquid, a sort of vapour, with a sound like the detonating of gunpowder, and are for this reason called bombardiers (*Brachi-*

nus). This vapour causes no pain, but only colours the skin brown where it has touched it. There are besides, other beetles which yield a yellowish fluid, either from their mouths, like the species of *Silpha* and *Necrophorus*, and the *Staphylinidæ;* or, like the oil-beetle (*Meloë*), from the joints of the feet. None of these liquids causes either pain, breaking out, or inflammation of the skin.

A very small beetle, scarcely perceptible to the naked eye, is sometimes very troublesome to us, by flying into our eyes, and causing a violent burning. This insect belongs to the family *Staphylinidæ*, and generally flies about in the evening. The best remedy for getting rid of this troublesome insect is also cold water, which is to be dropped into the eye, by which the insect will be washed out.

Finally, there are beetles whose whole bodies contain a peculiar acrid substance, which acts on us as a strong poison, both outwardly and inwardly. This property is possessed in a very high degree by the Spanish fly, or blister-beetle. (*Cantharis vesicatoria* Linn, *Lytta vesicatoria*, Fabr.)

CANTHARIS VESICATORIA.



This insect is distinguished by a beautiful metallic gold green colour, sometimes changing into bluish green. Its body measures eight or ten lines in length, and three lines in breadth. The males are usually smaller than the females. A peculiar and very disagreeable smell betrays these insects at a considerable distance from their abode. They are found generally upon the privet (*Ligustrum*), lilac, and ash, sometimes in such numbers that the twigs bend under their weight, and the trees are entirely robbed of their foliage*.

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* This insect is ordinarily of the rarest occurrence in this country, but at the meeting of the Linnæan Society on the 7th November, 1837, Mr. Newman exhibited a number of specimens, taken during the preceding summer, near Colchester, where they had appeared by millions, stripping the ash-trees of their leaves.

The time of their appearance happens in the warmest season, generally in the months of June and July. In the morning and evening they sit as if benumbed on the twigs, and only become animated as the warmth increases. They are not equally numerous every year, and are natives of almost every country of Europe, particularly those towards the south.

The Spanish-flies have a very pernicious effect on the human body from their vapour. Instances have been known of persons being attacked with violent fever, from having fallen asleep under trees infested by these insects.

Outwardly applied to the skin, they cause inflammation, and by long continuance on it, painful blisters are occasioned. This effect is caused not only by the cantharideous powder or plaster, but even by the whole insect, when it is held for a long time in the hand for inspection. By the continued operation of the cantharideous poison on the skin, it is drawn in by the absorbent vessels, and causes a swelling of the glands near the parts affected.

Besides the cantharides, many other sorts of beetles may cause similar effects on the human body, but of which we have not yet had experience. We only know that in countries where the Spanish-fly is not known, there are others closely allied to it, which are applied to the same medicinal purposes.

An effect similar to that of the cantharides, but in a much less degree, is said to be produced by the May-bug or cock-chaffer (*Maykäfer*).

Various, generally smaller, insects of this order may become very hurtful to man, by getting into the ears, and causing a disagreeable and painful feeling. The best remedy is pouring oil and warm water into the ear, which kills the insects.

2.—In the order Orthoptera, to which the earwig (*Ohrölen*, or *Ohrwürmer*), black-beetle, or cockroach (*Schaben*, or *Kakerlacken*), grasshoppers and crickets belong, there are undoubtedly more injurious sorts, which are, however, not so directly prejudicial to man, as they are to various vegetables and the products prepared from them, which will be described in the proper place.

The earwig is, though unjustly, the most dreaded; it is said to creep into the ear during sleep, and occasion violent pain. It enters houses it is true, particularly in the country, yet I never knew of any case where the insect had got into the ear. It is also much too large not to be felt, if it should attempt to effect an entrance*. If this insect should get into the ear, injections of oil and warm water are the surest means of driving it from its hiding-place.

Among grasshoppers (*Heuschrecken*) there are a great many species which have very strong masticatory organs, and bite very severely on being caught, yet their bite is quite harmless. In Sweden, according to Linnæus, the country people let a species of locust (*Locusta verrucivora*), which is also plentiful with us, bite into their warts, thinking this operation cures them.

3.—*Hemiptera.* To this order belong the house and field bugs, Cicadæ, froghoppers, Aphides, and scale insects Besides the troublesome bed-bug (*Cimex lectularius*), there are other field or tree bugs, which sting sharply on being caught. The water-bugs (*Wasser-wanzen*) do the same. Their sting, with the exception of more or less pain, is not dangerous. Cold water, or rubbing with oil, are the simplest and safest remedies.

4.—*Neuroptera.* To this order the *Libellulæ* or dragon-fly, ant-lion-flies (*Myrmeleonidæ*), day-flies (*Ephemeridæ*), caddice-flies (*Phryganea*), and the *Termites* or white ants belong. It contains, at least in our part of the world, no insect which is hurtful to the human body itself, though it is precisely in this order that the most destructive enemies to the property of man in the warm zones are to be found; I mean the termites, whose voracious appetite is only repelled by stone or metal. These creatures not only attack eatables, clothes, and furniture, but even destroy the wooden-work of houses, occasion the falling-in of the building, and expel, in the literal sense of the word, man from his abode. Many large species in Asia and Africa, are said even to attack man. In Europe there are only two native species of these fearful insects, viz.—*termes lucifugum* and *ruficolle;* they are found only in the southern countries, where they cause great damage to the olive-trees.

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* The prevalence of the opinion that this insect has been known to enter the ear, is attested by its name having become a term of reproach for the attempts of those who would, in an underhand manner, prejudice their hearers. That the insect in the dark will enter into any convenient cavity, is in accordance with its usual habits, and hence it may occasionally make its way into the human ear: but it is an out-of-door insect, in the first place; and in the second, even supposing it to enter the ear, the structure of that organ will prevent it from penetrating into the head, so that no serious apprehension nor alarm need be occasioned by its presence.

A third species, which I have named *Termes flavipes*, I found in the hothouses of the Imperial Palace at Schönbrunn, where they were no doubt introduced with foreign plants. This species does no injury to the living plants, but gnaws through the tubs in which they stand, and the other wood-work of the houses.

5.—*Hymenoptera*. By far the greater number of insects of this order are the most beneficial creatures in the great economy of nature. All the Ichneumons of Linnæus, which spread death and desolation among so many destructive insects; the sand-wasps (*Sphegidæ*), and ants (*Formicidæ*), which are more useful than hurtful, gall-flies, bees, wasps, and humble-bees, belong to this order. It is only among the latter tribes that we find species which can defend themselves against their persecutors, and repay the molestation we occasion them in a serious manner.

The most dangerous of these is unquestionably the hornet (*Vespa crabro*), and the other species of wasps. The instrument which causes the injury is placed in the hinder part of their body; it is a long sting, which they plunge into the skin, and at the same time eject into the wound a peculiar poison, which causes inflammation, swelling, and violent pain. The more tender and delicate the injured part is, the more important are the symptoms; and examples have been known of men dying of a wasp-sting. A man in drinking beer swallowed a wasp that had fallen into the glass, which stung him in the palate, and the throat swelled to such a degree that he was choked. Wasps are fond of ripe fruit, particularly pears and grapes; they sometimes scoop the fruit entirely out, and sit within the skin, so that it may easily happen that we may bite a pear, and have our tongue or lips stung by the wasps inside.

Many sorts of wasps have their nests and young in the earth, and it often happens that countrymen and gardeners meet with them in digging. The insects, thinking themselves persecuted, furiously attack the man, and do him serious injury. Hornets form their abodes in hollow trees, and revenge themselves in as fearful a manner when they are disturbed.

When we are stung by a wasp, we must wait till it flies away of its own accord, for if we disturb or kill it, its sting is left in the wound, and the symptoms are much worse.

The sting of the honey-bee is no less dangerous and painful, particularly when several sting at once; and we have examples of men suffering from inflammatory fever, fainting fits, and convulsions, in consequence. If they sting in the eye, blindness may be the consequence. Some old writers relate, that after repeated stings from bees, death ensued.

Bees inflict a wound by means of a sting fixed in the posterior part of their body, which is connected with a poison-bladder, from which the poison exudes into the wound. The bee very frequently leaves its sting in the wound, and every endeavour must be made to extract it.

For the parts wounded by wasps or bees, applications of cold water, ice, or damp earth, are the best remedies. Some recommend for wasp stings the juice of plantain, beaten in a mortar, or grated potatoes; but these applications require to be renewed every five minutes. Certain relief is said to be procured from a piece of linen constantly moistened with Goulard's lotion. Others recommend linen dipped in hartshorn to be applied to the injured places, or to rub them with oil, or white-wine vinegar, or to lay crushed parsley on the wound. If high fever be the result of many wasp or bee stings, letting of blood is requisite; the internal treatment must be very antiphlogistic, and under the direction of a physician.

Besides bees, wasps, and hornets, there are other *Hymenopterous* insects in the order which sting in a similar manner, although not so violently. To these belong, for example, the various sorts of humble-bees (*Bombus*), sand-wasps (*Sphex*), ants, &c. The stinging of all these causes the like symptoms, which therefore require the same treatment.

6.—The order *Lepidoptera* contains only harmless insects, which in their perfect state do no direct injury whatever to man. There are people, however, so timid and superstitious as to be thrown into the greatest terror if a moth, attracted by the light, enters their habitations; particularly when with its large wings it extinguishes the light, as is frequently the case with the death's-head hawk moth (*Sphinx atropos*). Such simpletons, however, may be quite easy, for the largest moth, terrific and formidable as it may appear, is not capable of doing them any injury.

But the case is very different with respect to the caterpillars of various moths, particularly the hairy larvæ of some *Bombycidæ*. These caterpillars neither bite nor sting, but their hair has the property of causing a burning itching, or even breaking-out on the skin, as soon as it comes in contact with it.

Amongst these destructive and injurious insects, the processionary caterpillars hold the first place, of which a fuller description will be given in another chapter. Touching the caterpillar, or its cast skin, not only causes violent itching, burning, and a breaking out on the body, and even inflammation of the eyes, when the face is rubbed by the hand immediately after touching one of these caterpillars, but even remaining under a tree infested by the processionary caterpillars will produce all these symptoms. The hair of these caterpillars, particularly before and during the time of casting their skins, being very brittle, breaks off and flutters about in the air; hence the grass under the trees is very much contaminated.

In destroying these insects, so injurious to forests of oak, every precaution is necessary to avoid coming in immediate contact either with the caterpillars or with their large nests, which are full of skins and hair. A late writer, Dr. Nicolai, asserts, that it is not so much the hair as a fine sort of dust which covers the skin of the caterpillar, which causes all the above-mentioned symptoms.

No remedy is yet known to remove, immediately, the bad effects caused by this caterpillar. The itching, burning, and breaking-out, usually last four or five days, and go off of themselves. Washing with cold water, or parsley-water, or rubbing with oil, will give some relief.

Similar effects, but in a more trifling degree, are caused by the caterpillar of the yellow-tailed moth (*Bombyx chrysorrhœa*), and many other hairy caterpillars, which should, therefore, be very cautiously touched by tender hands. Ladies who sit in gardens under fruit trees, often feel a burning in their neck and arms; this proceeds solely from these caterpillars, which have either crawled over the parts, or their hair has fallen on them.

7.—The order *Rhipiptera* contains no insect injurious to man.

8.—The order *Diptera*, on the contrary, is numerous in species which are very troublesome to man and beasts.

The best known, and most troublesome animals of this order, are the various sorts of gnats (*Culicidæ*, and the smaller *Tipulidæ*), to which belong the mosquitoes, so much dreaded in the tropics. Their larvæ live in stagnant water, ponds, puddles, gutters, &c.; hence their numbers are in exact proportion to the dampness, and also to the heat of the weather, in any year. It must also be observed, that their hostility increases with the increase of heat*, and that, therefore, these species must be far more troublesome in warm climates than they are in the temperate or cold regions.

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* This assertion cannot be maintained. The common gnat is most active during the night, and the Laplander has as much need of defence from the attacks of mosquitoes as the East Indian, to whom a mosquitoe-curtain is one of the greatest luxuries of life.

Gnats wound with their sucker (*saugrüssel*), which they plunge into the skin of men and animals, to suck out the blood, at the same time they instil into the wound a corrosive fluid, either to promote the flow of blood, or to make it more fit for their nourishment. The consequences of these bites are sufficiently known. Sure preventives for this evil are as little known as remedies that can be depended on.

Smoke is applied in many countries where these creatures abound, to drive them from the houses. They set fire to juniper-wood in the evening, open the doors and windows, and endeavour in this way to drive out the intruders, which are so troublesome, particularly in the night. In Southern Hungary I saw the roots of the Elecampane, which is there called "Gelsenwurzel," laid on the fire, in order to produce a smoke which is said to be particularly efficacious in driving away the gnats. But I did not experience the desired effect from this remedy; on the contrary, the smoke affected my head, caused headache, and gnats enough remained behind to disturb my night's rest by their humming and biting. The best means of preventing their bites in the night, is surrounding the bed with gauze or lawn. Washing the head with aromatic vinegar, or lemon juice, is sometimes a protection against their fury.

When we are stung by a gnat, we must not kill it on the skin, but suffer it to suck and fly away, otherwise it will leave its sucker behind, and the wound will be more inflamed and painful.

To assuage the pain, rubbing with oil is recommended, washing with parsley-water, salt-water, or Goulard-water which is to be had at the apothecaries', and in the absence of these, bathing with cold water or laying on damp earth. The specific antidote is said to be volatile spirits of sal ammoniac, or common hartshorn.

The commonest and most abundant gnat with us is the

Culex pipiens; there are, besides these, other species which are equally troublesome. Their malignity depends in no degree upon their size, but on the weather, the climate, and even the state of a man's body.

Many persons, under the same local circumstances, are either very little or not at all injured by them, or their bites cause but a faint itching or burning; while others can scarcely defend themselves from their fury, and experience burning pain, inflammation, swelling, and even a troublesome breaking-out, which is often of long duration, from their attacks. The reason of this is to be found in the peculiar moisture of the person, which either attracts or repels them.

A fly, still smaller than the gnat, named "Kolumbatscher-fliege*," is in some parts of Southern Hungary, particularly in the Bannat, as dangerous, if not a more dreaded scourge than the various sorts of gnats. They appear, fortunately, only at stated periods, and do not continue so long as the gnats; they attack domestic animals more than man, and for that reason will be more fully described further on.

THE GADFLIES (*Tabanus*, Linn.).—Many species of the Family *Tabanidæ* are the most bloodthirsty and troublesome insects known. Most of them attack our domestic animals, such as horned cattle and horses; but there are some species which annoy man. Of these the most troublesome are,

The TABANUS PLUVIALIS, *Linn.* (*Hæmatopota fluvialis*, Latreille).—It is not much larger than the common house-

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[*] This obnoxious little insect is described by Fabricius, under the name of *Rhagio Columbaschensis*. It evidently belongs, however, to Latreille's genus *Simulium* (amongst the smaller *Tipulidæ*,) judging at least from Coquebert's figure of it, which, although rude, sufficiently exhibits the veins of the wings.

I have myself often experienced much annoyance by another still more minute species of *Tipulidæ*, belonging to the genus *Ceratopogon*, which settles upon the exposed parts of the body, and inflicts a very sharp bite.

fly, and is chiefly distinguished by its large green eyes, through each of which run four brown undulating bands. The body is grey, with brownish cross stripes; the wings grey with brown spots. It frequents meadows and pastures, and attacks horses and horned cattle in sultry weather before rain; nor does man escape. Although the wound it causes is sharp, it does not produce any lasting itching or burning.

The TABANUS CÆCUTIENS, *Linn.* (*Chrysops cæcutiens*, Latr.), is larger than the house-fly; eyes golden-green, strewed with minute spots; thorax yellowish-brown, the upper part marked with three long black stripes; wings with blackish-brown spots on a white ground; abdomen narrow, pointed, the first two segments yellow, marked with a large black fork-shaped spot; the others greyish-yellow, and marked with two longish black spots in such a manner that a triangular space is left in the middle of each ring, with the point turned towards the extremity of the body. It is generally found abundantly in the end of June, in meadows and pasturages, and stings both men and horses very severely.

The CONOPS CALCITRANS, *Linn.* (*Stomoxys calcitrans* Meigen), is the universally known fly that torments man and cattle by its painful sting in the warm summer days, more especially before thunder storms. It generally keeps near the earth*, and attacks the legs, for which reason it has been called in Germany the leg-stinger, or "Wadenstecherinn." It has a great resemblance in form to the common house-fly, but is smaller, being about three lines long. The thorax is grey, short-haired, with black lines on the back; the abdomen oval, short-haired, grey, with shining black spots. The wings transparent and colourless. Its history, hitherto unknown, we owe to the labours of my friend, Mr. Heeger, who found the larvæ in 1834, and kept them till they were fully developed.

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* In our own country it is more commonly observed at the latter end of summer, in the windows of our apartments, where it may easily be distinguished from the common house-fly by its slender proboscis projected in front of its head; it bites the legs through the stockings, leaving a red spot, which is of a brighter red in the middle, and which continues for a considerable time. Mr. Curtis, contrary to the observations of Mr. Heeger, states that its larvæ live in dung.

It lives as a mining caterpillar (*minirraupe*), in the leaves of the burdock (*Arctium lappa*), coltsfoot (*Tussilago farfara*), and nightshade (*Atropa belladonna*). It is four lines long, of the thickness of a grain of oat, dirty white, with a retractile black rostrum on its head, and some little warts on the posterior of its body. When it is fully grown it leaves the inner substance of the leaf, and attaches itself in a fold on the under side of the leaf by means of some threads, or betakes itself to the earth to undergo its transformation. After fourteen or twenty days the perfect insect appears.

Besides the *S. calcitrans*, several other species of this family are known, which are more or less troublesome from their attacks on man and beast. The *S. irritans* is said particularly to annoy horned cattle in the north of Europe.

It is quite apparent that no remedy can be given for such a universal evil, unless we could destroy all the plants that serve the larvæ as food. The same remedies are to be applied to their bites which were recommended for the bite of the gnat.

In the order of two-winged insects, the species of true flies (*Muscidæ*), deserve to be mentioned, as particularly troublesome guests in our houses. Although their bites do not cause pain, still it is extremely disagreeable to feel them crawling over our faces, particularly when we are in a state of repose. But they may even be dangerous, particularly in their larva state. The larvæ or maggots feed upon animal as well as vegetable matter, particularly when it begins to decay. Open wounds, when they begin to suppurate, attract flies, and they deposit their eggs in them. In a very short time the maggots are hatched, and increase, by their sucking, the malignity and pain of the wound. They will even deposit their eggs on sound parts if they happen to be smeared with matter fit for the nourishment of their progeny. A physician of Vienna, submitted to me the larva of a fly which had come out of the ear of a woman. The woman suffered from deafness, and was obliged to have a small piece of bacon constantly in her ear. A fly, whether attracted by the bacon, or by an exudation from the ear, laid an egg in it, which became a larva, and caused the patient the greatest pain and bleeding in the ear. The pain was assuaged by the application of leeches, and the fly-maggot was ejected by syringing warm water into the ear.

Another physician in the neighbourhood of Vienna sent me similar maggots which had come from the nose of a woman, after she had suffered for some time from violent face ache. Apparently a fly had laid its eggs in this woman's nostrils while she slept in the open air; the larvæ had crawled into the perforations of the cheek bones, and remained there till their transformation. They then came out to seek a convenient place to become pupæ. Thus the woman was suddenly freed from pain. From want of cleanliness, particularly in children, these maggots might creep into other parts of the body*.

Washing and injecting warm water and oil are the simplest and best remedies.

9.—The order of *Myriapoda* contains in the genus *Scolopendra* some species, the bite of which, when enraged, causes pain, inflammation, and swelling. The largest European species of this genus is the

Scolopendra morsitans, Linn.—This insect is only a native of the southern countries of Europe. In the Austrian dominions of Italy and Dalmatia only, it lives under stones, decayed wood, foliage, in the earth, and particularly in dark and damp places. Its body is flat, composed of twenty-one rings without reckoning the head ; each of these rings has a pair of feet. On the head are two long antennæ, with twenty-two articulations, and a pair of thick, very pointed *chelæ* or mandibles bent inwards, which are hollow, and have an opening at the top. Through this opening they inject into the wound which their bite occasions, an acrid poisonous juice. According to their age they are four, five, or six inches, and more, in length ; their breadth is half-an-inch and more ; their colour is brown, sometimes lighter and sometimes darker. Their bite is followed by considerable swelling, accompanied by inflammation and fever.

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* The Rev. F. W. Hope has recently read a very elaborate paper before the Entomological Society, in which he has collected together, from a variety of sources, a great number of cases in which the larvæ of various species of insects, belonging to different orders, have been discharged from the human body. The results of cases have been condensed into tables, which have been published in the *Medical Gazette* during the last Spring.

To obviate the bad effects of the bite, good Venetian turpentine is recommended to be laid on the place ; in the absence of this, cold poultices and rubbing with oil are of great service.

A species of *Scolopendra*, resembling the *S. morsitans*, but much smaller, lives in the neighbourhood of Vienna, it is the

GARDEN SCOLOPENDRA, *Scolopendra hortensis*, Linn. (Crytops, *Leach*). — It lives in gardens and woods, under fallen, decaying leaves, and in dung. It is only two inches long, and one to one and a half lines broad, with twenty-one pairs of feet of a rusty yellow colour. It puts itself in an attitude of defence on being touched, and I have several times felt, after its bite, very violent pain on my fingers, but unaccompanied with inflammation, and which disappeared in a short time without any remedy being applied. The commonest Austrian species is the

Scolopendra forficata, LINN.—It is chesnut-brown, an inch and upwards in length, from one to one and a half lines broad, and has only fifteen pair of feet. Although it also defends itself on being caught, and bites with its chelæ, yet its bite causes no great pain.

There are yet other species belonging to this family, which live in damp earth, are very long, having sometimes 112 to

120 feet and upwards; with their weak mandibles they can cause no pain to the external parts of the body; but it is said that they crawl sometimes through the nose into the temples, and cause violent headache. These accidents, if they really ever do occur, must be very rare, for these creatures are extremely shy, and do not readily leave their lurking-places.

The tenth order of insects (*Thysanura*), contains no species injurious to man or domestic animals.

In the eleventh order (*Parasita*), to which lice belong, and in the twelfth order, which only contains the family of the flea, the injurious species are well known.

Class *Crustacea*, (Crabs, Lobsters, &c.)

In the whole class of *Crustacea*, which do not differ from insects in essentials, and were included amongst them by the older naturalists, the common crayfish (*Flusskrebs*) only deserves to be mentioned.

All the species of fresh-water crabs are small, the most part even microscopic insects, which can in no way injure man; only the common crayfish (*Astacus fluviatilis*), which sometimes attains a considerable size, defends itself against its pursuers with its strong claws, and may certainly wound the fingers. But as no poison is injected into the wound, it heals in a short time without the intervention of any remedy.

Among the sea crabs there are larger species, provided with stronger weapons, but even these only wound mechanically, and nothing can be recommended but caution in catching them.

Class *Arachnoidea*, (Spiders).

Perhaps there is not any insect to which man has a greater dislike than to a spider, yet the foundation of this dislike lies rather in a prejudice which we feel against these ugly creatures, than in a conviction of their hurtfulness.

I have perhaps caught most of our native spiders alive in the naked hand, and very seldom, indeed only once, have I been punished for my boldness by a painful bite.

We read in various works that spiders often eject a corrosive poisonous juice, in consequence of which the joints become inflamed and swelled; and even that the crawling of a spider is sufficient to cause inflammation in the parts which it touches. It might perhaps be too rash to contradict the assertions of many writers, but I have never found these observations adduced by men who have been exclusively occupied with the study of spiders, nor have I ever experienced anything of this kind myself throughout the many years in which I have been engaged in studying insects and spiders.

All spiders are, however, insects of prey, and feed on other insects, which they catch alive, kill, and then suck out their fluids. For this end they are mostly provided with very strong *chelæ* or mandibles. These *chelæ* are of a horny substance, bent inwards, hollow, and provided with an opening at the top, and are connected with glands, which secrete a corrosive juice. They discharge this juice into the captured insects they have wounded, apparently to kill them sooner. The same thing happens when they wound a person who has caught one, and gives it pain. Pain will naturally be the consequence of the wound, and the corrosive juice communicated to it; the wounded part becoming inflamed, and swelling. The larger the spider, the warmer the climate or the season of the year, and the more susceptible the wounded individual, so much worse will the effects be, and it is therefore no wonder that people who would have a fester from a simple prick with a needle, should feel more violent effects from the bite of a spider.

Thus the bite of the tarantula in Southern Italy, namely, Apulia, according to late observations, is said not to be nearly so dangerous as it was considered formerly, and the disease attributed to the bite of the tarantula is said to be more the consequence of the climate and manner of life of the people*.

It is, however, an indisputable fact that spiders defend themselves when they are persecuted and captured, bite with their *chelæ*, and drop into the wound a more or less poisonous juice, although the consequences are very seldom dangerous. As I have already mentioned, I was once rather sharply bitten by a spider; it was a large pale-green species, which lives among reeds, and between leaves fastened together in the form of a paper cornet by a white web, and keeps itself concealed there with its eggs; it is called *Clubonia nutrix*. The bite caused very violent pain without inflammation, and passed away in a very short time without any remedy being applied to it.

SCORPIONS.

To the class *Arachnida* belong also the scorpions, which are more dreaded than spiders. There are hitherto but three species known in Europe†, all of which are only to be met with in the southern provinces. The Tyrol, Carniola, and Southern Hungary, are the extreme limits within which the scorpions live. They reside in dark places, in old walls, under stones, under the bark of trees, in rotting wood, and even creep into beds.

The scorpion, which is a native of the Tyrol and Hungary, is of a dirty yellow colour, nearly one and a half inches long. The Italian species is longer, nearly two inches long, dark chesnut brown; the third species I had from the Ionian

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* The tarantula (*Lycosa Tarantula*), derives its name from Tarentum, in Italy, where it appears to have been most abundant, and where the inhabitants exhibited, when bitten by this insect, symptoms of extreme irritation, amounting to a disease which had been named Tarentism, and which it was pretended was only to be cured by music; more recent observations have, however, pretty clearly demonstrated that these symptoms were a long practised deceit.—(See British Cyclopædia in art. Tarantula, and Mag. Nat. Hist., New Series, No. 2).

† M. Kock has published the figures and descriptions of several additional European species in the recent numbers of the little work entitled, "Die Arachniden."

Islands. It is considerably larger than the two foregoing species, and of a light yellow colour.

The instrument with which the scorpion inflicts a wound is placed on the last joint of the tail; it is a very fine sting, bent backwards, at the top of which on both sides is a small opening, through which the insect instils a poisonous juice into the wound it has made.

In most cases the sting of the scorpion causes scarcely so much pain as that of a bee or a wasp. Those of the Tyrol and Hungary are the least dangerous; I have been repeatedly stung by them, and felt no other sensation than that of a prick of a fine needle.

The sting of the Italian scorpion is said to be more severe; it is also found in Southern France, and in Switzerland on the borders of Italy; its effects, however, have never proved fatal.

The usual remedy for the sting of a scorpion is scorpion-oil, the common sweet or salad oil in which scorpions have been immersed for a long time. This oil, assuredly, has no other effect than any other simple oil, for it is not to be supposed that the oil can extract a healing matter from the bodies of the scorpions.

The sting of the African and East Indian scorpions is said to be much more dangerous, and even fatal in its effects; they are very large, and sometimes attain the length of a foot and upwards. Venetian turpentine laid upon the wound is said to be a specific.

Ticks (*Ixodes*, Latreille).

Ticks also belong to the class *Arachnoidea*. The body is without wings and rings, and has a scaly-looking plate on the anterior part. Each insect has eight feet, and a rostrum or sucker formed of three horny barbs; it is serrated and enclosed in three lancet-shaped plates. When fasting, its body is not thicker than pasteboard, but when full of blood it swells to the thickness of a grain of hemp-seed, a pea, and even a bean. These insects bore into the skin without causing any pain, and it is only when they begin to suck, that the place which they attacked becomes inflamed, and violent itching and burning ensue. Owing to the barbs on their rostrum it is impossible to draw them out of the skin, the head is usually broken off, remains in the wound, and causes a sore. We must, therefore, endeavour to remove them cautiously, with a needle or small knife. Smearing them with oil is said to kill them and make them fall off.

Ticks do not propagate on animals, but in the open air, and live in moss and on the leaves of various shrubs, particularly broom (*Genista*); and people are exposed to their attacks if they sit on the ground amongst underwood during the time of wood-cutting. Dogs, and the different sorts of domestic animals when they feed in pastures, are most tormented by them*.

MITES (*Acarus*, Linn.)

Mites are very small insects, scarcely visible to the naked eye, which are also considered as belonging to the class of *Arachnoidea*. Each insect has an oval, very pale, and almost transparent body, beset with many long bristles, a short sucker, and eight legs also furnished with bristles. One species, the meal or cheese mite, is not only found in old spoiled flour or meal, and in cheese, particularly in the rind, but also in other eatables when they have long been stored up. That these living atoms have no injurious effects on the health of man, is proved by the use of cheese infested by them, which if eaten in moderation has no bad consequences. Spoiled meat, of which perhaps two-thirds are composed of mites, is perhaps more hurtful from its nature, than from the mites it contains.

It has been clearly proved in modern times by microscopic observations, that in people affected by the itch, an insect similar to one of the above-named mites *is produced in the skin**, near the pustules. Whether this mite is the cause or the consequence of the disease, is difficult to determine; it is only certain that with the disease the mite also disappears, and that the remedies which remove the itch also kill the mites.

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* A species of *Ixodes* is found in Persia, the bite of which, according to various authors, is attended with death. A paper upon this insect was read before the Natural History Section of the British Association at Liverpool, in September, 1837, and an article upon it appeared in a late number of the Penny Magazine.

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* It would appear from this observation that M. Kollar has adopted the opinion of Dr. Burmeister, respecting the equivocal production of these creatures, not from parents of their own species, but from the diseased skin of their victims.—I am obliged to differ from these gentlemen in respect to such an equivocal and unnatural proceeding, and adopt the arguments which have been used by an anonymous writer in the Entomological Magazine, in opposition to this view of the subject.

II.—INSECTS WHICH LIVE CONSTANTLY ON OR IN DOMESTIC ANIMALS, AND PROPAGATE ON THEM.

LICE. (*Pediculus*, Linn.)

AMONG insects which continually live on domestic animals, propagate on them, and when their numbers are too great, cause serious injury to them, the various species of lice (*Pediculi*) unquestionably hold the first place.

Every animal nourishes, under particular circumstances, on its skin, in the hair, wool, and even the birds among their feathers, a species of louse. Sometimes various species of these parasites lodge on one and the same animal; for example, on the horse, a particular sort lives in the short hair, and another species in the mane.

Although the appearance of lice on our domestic animals can never be agreeable, and must always be very troublesome to themselves as well as to man, they are more especially to be dreaded, and deserve the utmost attention on the part of the agriculturist, when they have so greatly increased as to cause the disease termed *Phthiriasis*. This disease is, alas! rather common, and the cause is chiefly to be found in want of cleanliness. When the domestic animals are kept in dirt for example, the horse and ox not curried; when the dust and sweat accumulated among the hair has been suffered to be in contact with the skin for a long time; when the animals are kept in dirty unwholesome stables, or when a clean beast comes in contact with an infested one, *Phthiriasis* may be the consequence. Daily experience shows that these nauseous parasites prefer cattle which have been reduced either by hunger or bad fodder, or by having been driven late in autumn into marshy pastures, where they could obtain only watery fodder. This disease also sometimes appears after inveterate, malignant, or chronic diseases have weakened the animals.

Old horses are more subject to the disease than young ones; the reason is obviously that they are kept more out of doors, and not so well attended to, and but too often worked above their strength, and kept on bad food. Their skin is generally hard and tight, their hair rough and thin. The lice fix their habitation mostly at the roots of the hair of the tail and mane; and sometimes we find horses entirely covered with them.

In horned cattle the lice have no particularly favourite place. They run up and down over the body of the sheep, and their presence is discovered by the separation of the wool from the skin. They swarm in every part of swine, and even gnaw, as Viborg declares, into the skin, muscles, &c., so that they come out of the nose, mouth, and eyes, and even with the excrements.

All animals which are attacked by lice, are extremely annoyed by them, and fall away considerably, partly by the actual abstraction of juices, and partly by the uneasiness which the itching occasions. Horses bite each other with their teeth till the blood comes; the places most infested often become entirely bare; thus, for example, the hair of the manes and tails of horses fall off, the hair of the head and neck of horned cattle, and the wool of the whole body of the sheep. We not unfrequently see sores on the surface of the skin, arising either from the gnawing of the lice, or from rubbing against the manger, trees, walls, &c. Sheep tear up their own wool, and the presence of lice can be detected by the tufts projecting over the uniform surface of the fleece.

From simple *Phthiriasis* actual injury is not to be expected, if the remedies above proposed are resorted to for killing the lice, united to the common means of preserving cleanliness, whereby a speedy recovery may be expected. Bad consequences are only to be feared when the evil has become almost chronic by long neglect, or when another rooted disease has arisen from it, or finally when an animal is so much reduced as to give no hope of being further serviceable. Before we begin to treat for the *Phthiriasis*, the healthy animals must be separated from the infested ones; and the former put into an extremely clean stable, with proper fodder. The greatest attention must be paid to cleanliness. The animals swarming with insects (horses as well as oxen) ought to be curried twice a-day in the open air, when the season permits, and driven into good pasture. Infested sheep should be separated, and kept folded on a piece of dry ground; swine infested with this insect should be removed from small pigsties into the open air, or put in large ones.

We must next inquire how the disease has been produced. If it has been occasioned by dirt, insufficient food, or want of bodily exercise, then, above all, common remedies and moderate exercise are to be advised. For this purpose only a few of the remedies given below are to be applied. If the disease appears after any other disease, and seems to be in close connexion with it, the direct treatment for this secondary affection would only be a palliative, if we did not combat at the same time the original complaint, or the primary cause of it. Besides, all these various prudential measures may render the actual use of medicine, such as powder, washes, salves, which operate directly in killing the lice and nits, unnecessary.

Of all the separate means, rubbing with quicksilver would undoubtedly be the most speedy and effectual for killing the lice. But can this means be resorted to when the whole surface of the body is covered with these parasites? And should we have nothing to fear from the irritating effects of the quicksilver? Might not salivation take place? We cannot adduce any facts in answer to these questions.—It is usual to begin the washing with a decoction of tobacco-leaves in a strong lye (also a very effective remedy against fleas in dogs); it may, however, easily become dangerous, as by its unskilful application the narcotic poison of the tobacco may cause death.

The seeds of *Delphinium Staphysagria* might also be used, and are considered a very good remedy for lice; or the salve which is applied as a cure for this insect, mixed with red sulphuret of arsenic, may also serve as a foundation to remedies of this sort. Vitet prescribes the internal use of sublimate of brimstone (flower of brimstone), fumigation with cinnabar and incense, washing with a strong infusion of tobacco-leaves, or hemlock, in water mixed with brandy, and when this is not sufficient, rubbing with quicksilver. The same infusion is necessary for sheep, or one of colocynth, with a grain of corrosive sublimate, which solution is to be poured over the back of the sheep. The English make use chiefly of white arsenic and corrosive sublimate for the lice in sheep; but Ifferson blames this treatment on account of the dangerous nature of these substances.

Tessier recommends the following means.—A common pair of bellows is taken, and a bellows pipe fixed to its side, which is to be filled with inferior tobacco, and set fire to; one man holds the sheep between his legs, another parts the fleece in various places, and a third blows the tobacco-smoke on the skin, and in this manner fumigates by degrees the whole body. The sheep must be kept in the open air some time after this operation, otherwise they might suffer from the vapour. Boutrolle recommends in his book, called the Perfect Shepherd, a thin solution of arsenic, which is to be poured on various parts between the wool, and then rubbed in with the hand, so that the whole covering of the skin is wetted. Ox-lice are to be expelled by washing with an infusion of *Staphysagria* powder and crushed pepper in strong vinegar.

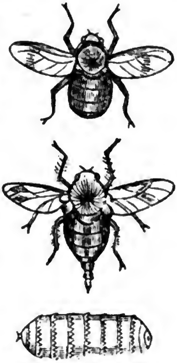
Finally, Viborg prescribes for the lice in swine, the internal use of the black sulphuret of mercury (*Ethiops mineralis*), mixed with kitchen and bay salt, and washing the parts most infested with arsenic-acid.

For the ox-louse, *Ledum palustre* is employed with success. It must be gathered in flower and dried. A few handfuls of flowers are taken, and more if there should be many animals, put into a pot or kettle, and a brown juice boiled out of them. If it be too strong and sharp for a tender thin-haired calf, which we know by feeling with the hand, it is to be diluted with warm water. A long-haired soft brush, capable of soaking up a great deal of the liquor is now taken, and the animal well brushed all over, so that not only the hair but every wrinkle in the skin, and particularly about the head, neck, and tail, may be thoroughly wetted and soaked. A cloth or rag is quite useless for this purpose, for the liquor would only run over the hair, and the skin with its lice and nits would be left dry. When this has been done, fine-sifted ashes are to be strewed all over, and rubbed in with the hand, that the liquor may be longer retained, and have its full effect. Next day the operation is to be repeated, on account of the nits, for the lice, if properly washed, are already dead; but the animals do not undergo the operation so patiently the second time, which, however, we need not care much about. The third day a weak lather of soap is made and the sheep are washed. The remainder of the clean liquor in the pot may be given to the other cattle for a drink, which is very wholesome and agreeable to them, as *Ledum palustre* is the principal ingredient in all cow powders.

If the cattle rub themselves against walls, troughs, pillars, or posts, now or afterwards, till they are bloody, no uneasiness need be felt on this account. Some linseed oil must be smeared over the place, and it soon heals. The plague has been got rid of, and the cattle will thrive in peace.

THE HORSE BOT. (*Œstrus equi*, Fabr.)

It may be regarded as a singular phenomenon that there are insects which live in the inside of animals, as well as intestinal worms. One of these is the Horse-bot, a larva proceeding from a fly resembling a humble-bee with two wings, and accordingly belonging to the *Dipterous* order. The female lays her eggs on the shoulders, manes, and knees of horses, which they lick off and swallow. They hatch in the stomach, and feed in the larva state all the winter on the mucilage. In spring they are found in the stomachs of most horses, and often in great numbers. They resemble in size and form a date-stone, having two hooks at the fore end with which they adhere to the inner coat of the stomach. They penetrate in this manner often from three to five lines deep into the white insensible tissue, and become as if distorted by it; or they bore through the stomach* in many places. Sometimes these larvæ even pass the pylorus into the *duodenum*. They have fifteen rings, are enveloped in a hard firm skin, which is also set with short prickles. They are twelve or fifteen lines long, and the diameter of their thickness is equal to a quarter of their length. To this may be added that they are always to be found in various stages of development in the same horse.



GASTEROPHILUS EQUI, LEACH.

These bots live in the body of the horse from June or July till the following May or June, so that in opening a dead horse, they are almost always to be met with. If they are not numerous the horse does not seem to suffer, but when there are many, they cause violent pain, and necessarily injure digestion, as they both irritate the stomach, and extract a great deal of the nourishment from the animal. Hence, Walisneri ascribed an epidemic among the horses about Verona and Mantua to the bots. Doctor Gaspari examined the dead horses, and found that a great number of these larvæ had eaten into the inner coat of the stomach; and that the outer coat of the stomach was inflamed. The transformation of the larva into the perfect insect takes place in the same manner as in the *Œstrus* of the ox. When they are fully grown they detach themselves, and fall out with the excrement. They then bore into the earth to become pupæ.

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* Mr. Bracy Clark in his admirable Essay on this tribe of insects observes, in opposition to this remark, "They (the bots of the horse) make small deep round holes when they adhere to the white tissue, and sometimes so deep as to pass through it, but *not* through the other layers or coats of the stomach, as has been often hastily apprehended, and asserted that they are probably but little felt by the animal" (p. 21).

Bots, when they are very numerous, cause long continued pain to foals. The presence of these larvæ in the stomach may be guessed at, when the animal is dull and indifferent, becomes thin, shows an irregular, and often unnaturally voracious appetite, when the hair becomes as if singed and bristly, the growth of the young animal is interrupted, and the belly contracted, and when the animal sets its hind legs far under its body, and frequently opens its jaws, or moves the under one constantly from one side to the other. It also groans sometimes, trips, or takes repeated short steps, and on being kept a day or two in the stable has its hind legs swelled. The epigastrium is constantly sensitive, and as the animal becomes still leaner and leaner, it becomes voracious, and an increase of pulsation takes place. The animal now raises its head frequently, stretches out its neck, looks fixedly towards its left side, prefers lying on that side, extends itself at length on the straw, and moves its head and its gradually stiffening neck backwards; its tail, which is almost always raised, is also directed backwards. From time to time attacks of colic come on, which, however, are milder in regularly well-fed horses, than in those which have their food irregularly, and which, on account of the sort of work they are employed in, must often fast. During the colic the animal trips and totters more violently, and frequently strikes its body with its hind feet; but unless the agony is very great, it seldom rolls, or not violently. The pain is dull and deep; and though it is almost constant, it is not accompanied by those violent and irregular movements, and apparent agony, by which acute colics are recognised. A short stomach cough, which seems to come deep out of the breast, accompanies these symptoms. Lastly, the under parts of the legs, sides of the abdomen, and the scrotum, are filled with lymph, and the whole condition of the body announces bad food and organic weakness*.

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* It is perhaps too much to assert that the various symptoms given in the text are produced by the presence of bots in the stomach; indeed

There seems to be a particular disposition in some horses to show the above-enumerated symptoms in a greater or less degree; for we often find in horses killed on purpose, or in those that have died by chance, that hundreds of bots have bored, or been absorbed into, the pituitous tunic of the stomach, without the above-named symptoms having shown themselves. This is especially the case with all grass-fed horses.

To relieve the afflicted horse from these plagues sooner than they would disappear of themselves, the same remedies are made use of which are applied with more or less success for intestinal worms. To these belong especially the more violent purgatives, as jalap, aloes, scammony juice, &c. which, however, operate less by their vermifugive powers than from their violent agitation of the intestines, in consequence of which the worms are detached from the pituitous tunic, and are carried off. These remedies must be administered with the greatest caution, and always under the directions of a farrier; because if applied in too great profusion, they cause great irritation in the intestines. If their application is thought advisable, they are only to be given in small doses, continued at intervals, during which, bitter plants which are considered true poison for worms and bots, are to be used; for example, the root of the male fern, of wild valerian, sage, wormwood, tansy, gentian, &c.,

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Mr. Bracy Clark, whose long practical knowledge of the subject entitles him to be considered as a leading authority on the subject, adopts the opinion not only that they are not actually injurious to the horse, but that they are even beneficial; thus he observes, that "the white tissue of the horse's maw is certainly less sensible than the other parts of the stomach," but that "if the tone of the stomach should be changed by inflammation or other diseases, their roughness might perhaps become then very sensibly felt, and their powers be changed."—How far we are to consider as well-founded his conjecture that they contribute to the health of the horse, "by their gentle stimulus to the stomach, and by promoting the digestion of their low watery food, prevent the cholic, gripes, and other indigestions, which ultimately affect the head of the horse, and produce staggers," is a point not yet determined, although the author has endeavoured to support it by several striking arguments. An opposite view of the subject has been taken by Mr. Sells, in a memoir read before the Entomological Society.

soot, garlic, asafœtida, camphor, petroleum, turpentine, and preparations from it, as well as all essential oils, have a similar effect. In many cases, preparations of quicksilver, calomel for example, are of very great service.

Chabert recommends Dippel's animal oil for extirpating both intestinal worms and the bots; and adds that he has proved by repeated experiments that intestinal worms die in it in from four to six minutes; though the bots will live three hours in it. A dose of this oil, which may contain from four drachms to two ounces, may be taken daily, for several days in succession, and increased or diminished according to the age or strength of the animal. Some hours after swallowing the medicine, which must be given fasting, and the animal kept without food from four to five hours after, mucilaginous or oily injections are applied. While the patient is suffering from colic or violent pain, the oil must not be given, but the pain may be alleviated by assuaging remedies, such as oily drinks, and decoctions of mucilaginous plants into which some poppy heads have been thrown.

People have tried to explain why the bots resist the operation of this oil better than the true intestinal worm, as in many cases they continue to live in spite of this remedy; and have looked for the reason in the structure of these larvæ, in their firm seat in the pituitous tunic of the intestines, and in their being able to prevent injurious substances from penetrating into their bodies, by contracting their rings, closing their air-holes (*stigmata*), and plunging their suckers and hooks into the hollows which they had made in the pituitous tunic. It has also been imputed to the circumstance, that the bots mostly live on the upper part of the stomach, and consequently can more readily escape the effects of the vermifuge. To give it a more powerful effect it has been proposed to add sulphuric ether to the oil, with the view that the larvæ might become as it were drunk with it, and be the easier affected by the animal oil.

By this addition the medicine will be rendered extremely powerful, but on this account the use of it will require greater caution. In unskilful hands it might cause the greatest mischief, and even kill the patients; particularly if the indispensable precaution should have been neglected of feeding the animals for a few days previously with gruel only, and giving them from time to time mucilaginous drinks, and injections of the same kind.

Whitlaw the Englishman says that the American arbor-vitæ (*Thuja occidentalis*), administered inwardly, and the expressed juice of the common elder, either alone or mixed with tar, will be found very effectual in protecting cattle from the bots and intestinal worms. The leaves and young shoots of the arbor-vitæ are to be beaten in a mortar with a little water, and the juice expressed. The horse is to take a quart as a preventive remedy every quarter of a year on an empty stomach, and if the animal is very ill, this quantity is to be given three times a-week*.

THE FUNDAMENT BOT (*Œstrus hæmorrhoidalis*, Linn. *Gasterophilus hæmorrhoidalis*, Leach).

It was called formerly the *Afterkriecher*, because it was thought that the female laid her eggs in the anal opening of the horse†, and that the larvæ proceeding from them crept through the bowels into the stomach; but later observations show that the female of this bot lays her eggs on the lips of the horse, whence they are licked off and swallowed, and thus get into the stomach.

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* Mr. Bracy Clark doubts the beneficial results from any of these kinds of remedies, considering them for the most part as mere nostrums, which are not difficult to be forced down the horse's throat without their getting into the throat of the worm, which, being placed in its own element, can refuse food which does not suit it. Oils, too, which might seem more efficacious by closing the spiracles of the bot, and thus destroying it, are so soon reduced to a soap, and digested, as to be scarcely more availing. And as prevention is better than cure, he suggests an effectual mode of preventing the introduction of the bots into the stomach, by washing off the eggs (which are very conspicuous), from the knees, mane, and sides of the horse, or what is more effectual, by removing them with a pair of scissors.—(*Essay on Bots*, p. 43.

† This mistake of the habits of this species evidently originated in Dr. Gaspari having confounded the *Œstrus hæmorrhoidalis* with the forest-fly, *Hippobosca equina*, which gets under the tail of the horse.

The bot-fly itself is half an inch long, has brown unspotted wings, a dark abdomen, which at the base is white, but reddish-yellow at the extremity.

The larva resembles that of the preceding species in its habits, and is also found with it in Spring in the stomach of horses. Their colour is not so red, their body has two rings less, and their hooks are longer and sharper.

The most unequivocal token of the presence of the larvæ of the fundament-bot, is when the horse voids them with excrement, or when they are found on the closing muscles of the anal opening. When the hand of the farrier is introduced into the fundament of a horse infested with them, a greater or less number of these larvæ are found adhering so closely to the pituitous tunic, that it is very difficult to detach them; besides this, the fundament is almost always dry and distended; and the epidermis dry and unpliable, as if baked, and the hair bristly, as is the case when other worms abound.

When we are fully convinced of the presence of the fundament-bot, in the manner described, it is comparatively easy to release the animals from this plague. Injections of animal oil are applied, which kill the larvæ, and they are thrown out with the excrement.

THE OX-WARBLE* (*Œstrus bovis*, Fabr.)

An insect, also belonging to the order *Diptera*, larger than the house-fly, at the first glance resembling a small humble-bee, from which it is distinguished among other

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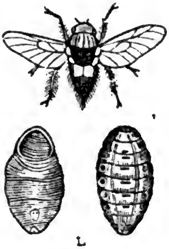
* The name bot is applied exclusively to the larvæ of those species of *Œstridæ* which reside in the stomach of the horse, and warble to those which burrow into the back of the ox. The perfect insect seems to have been indiscriminately termed breeze, or gad-flies, which names have also been given, with equal want of discrimination, to the blood-sucking-flies *Tabanidæ;* whereas the *Œstridæ* in their perfect state are quite innocuous, although capable of inspiring the greatest dread amongst a drove of oxen.



ŒSTRUS BOVIS.

signs by the want of two under wings, is a great plague to horned cattle. Although this insect annoys the stag, the roe, and the camel[*], as well as the ox, it has been named only after the most useful of these, the "ox-warble." It has brown unspotted wings, and on the abdomen, which is covered at the end with reddish-yellow hair, a black band. The female lays her eggs by means of an ovipositor, (which consists of four joints, which slide into each other like the parts of a telescope) on the skin of the back of oxen, and the other above-named animals, and only one at a time. The eggs are hatched by the animal heat, and the larvæ[†] cause larger or smaller swellings, generally about the size of a pigeon's egg, and are called warbles or wurmals (*q. d.* wormholes). They live on the moisture which is constantly produced by the irritation they occasion, and which is afterwards replaced by real matter, as the surface of the cavities in which the larvæ live is covered with a pus-secreting skin; they also constantly preserve in the middle of the swelling a small opening, through which they inspire air by means of their air-holes placed on the posterior end of their body. The larva is without feet, like the larvæ of all two-winged flies; it is dotted on the upper surface with very small grains, which appear under the magnifier like short, triangular, yellow prickles. These prickles serve to create an irritation in the skin of the cattle, and also to transport the larva to another place, when it has left its first station. It lives in the tumour from August till the following June, then pushes itself through the above-named hole out of the skin, falls to the ground, and creeps into it to go into the pupa state.

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[*] Surely the author must here have confounded several species together, as it is scarcely to be supposed that the same species of *Œstridæ* would attack such different animals; indeed one species has long been described under the name of *Œstrus Tarandi,* and which is attached to the Reindeer.

[†] The author has omitted to state, that immediately after being hatched the young larva burrows through the skin of the back of the ox, leaving the aperture subsequently mentioned, which is of the greatest service, being the only means by which the insect obtains a supply of air.

Usually only from four to five, but in rare cases as many as forty tumours are found in one beast, mostly on the back. A remarkable instinct seems to teach the parent fly, that although she lays several thousand eggs, she must not exact too much from a single beast, for the torments they suffer are by no means inconsiderable. Young, healthy, and fat cattle are, on account of the pliability of their skin, which the parent fly can easily penetrate, most exposed to the warble*, therefore the cowherds consider the tumours as a sign of health. The tumours may in many cases contribute to the health of the cattle, as they operate as a kind of seton, but when they are very numerous the cattle grow lean, and the cows give less milk. Cows are more exposed to the attack of the parent fly in the vicinity of woods than in meadows, and these parasites are always to be met with in greater numbers in the one place than in the other. The wounds caused by the flies in laying their eggs, appear only to be painful when they injure a nerve, the animals then run about as if they were mad.

There is a very simple and safe remedy to rid cattle of this troublesome torment. We have only to enlarge the opening of the tumour with a knife, and press the sides of the swelling, when the larva protrudes itself. The wound heals without further remedy, and it is only to be kept clean. It sometimes happens that the larva comes out by simply pressing, without enlarging the hole.

THE RED BOT. (*Œstrus nasalis*, Linn. *Gasterophilus veterinus*, Clark, Leach.)

The perfect insect is nearly of the size of the honey-bee, and in most years it is tolerably numerous in Germany. The thorax is rose-coloured, the wings unspotted, and the abdomen is black at the base, whitish gray, set with yellow hairs at the further end.

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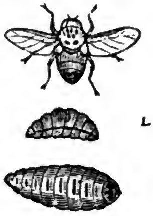
* The opinion that it is the parent fly, and not the young larva, which perforates the skin of the oxen, cannot be maintained.

The female lays her eggs in the nostrils of the horse, ass, stag, and sheep *. The larvæ, which cause an itching in these tender parts, and thus provoke sneezing and sniffing, frequently get into the cavities of the gullet and cause much pain. They are cylindrical, something thicker behind, brownish yellow, and covered with prickles at the incisions, the two latter excepted. Instead of air holes behind, they have a black cross line, through which they breathe.

Their food consists of the mucus they find in these parts. When they are large enough they cause a tickling by their crawling, and are then thrown out of the nostrils by the sneezing of the animal. Sheep and deer die when they have a great number of these insects in them.

THE SHEEP BOT. (*Œstrus ovis*, Linn.)

The thorax in the winged insect is brownish black and dotted with white, the abdomen white spotted with gray and black. The forehead looks ash gray, and is covered with many small deep punctures; the wings are shining and dotted at the base. It lives in the vicinity of woods, in sheltered shady places, where it is found in great numbers in warm summer days. It annoys the sheep very much; and in order to escape from its attack, they carry their heads low, and thrust them under the belly of the next sheep. The females lay their eggs in the nostrils, and the larvæ creep up into the frontal sinus, along the pituitous tunic, which they attach themselves to, by means of two hooks; otherwise they would easily be ejected by the sneezing of the animal. Their rings are



ŒSTRUS OVIS.

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* Several distinct species are evidently here confounded together.

not furnished with prickles, and at the side of the anus are two small warts. Their transformation takes place in the same manner as in the other species. More than three or four of these larvæ are seldom found in one and the same sheep, but they cause the disease called the staggers, and torment the animal greatly. The larvæ live from June or July to April or May in the following year in the animal, and as soon as the period for creeping out has arrived, they detach themselves, are ejected by sneezing from the sheep, and become pupæ in the earth.

The signs by which the presence of the sheep-bot in the nostrils, frontal cavities, and sometimes even between the pituitous tunic and the parts which it covers, is known, are —the suffering condition of the animal, the nausea, or the irregular desire of eating, the slow pace, the weakness, frequent sneezing, turning the head, holding it down, and the inclination it has of pushing itself against the nearest object.

A shining, pus-like matter flows from the nostrils, which often so firmly adheres to the apertures as to close them up, and cause difficulty of breathing. Besides this, dulness and indifference, redness of the outer skin, inflamed swelling of the gums and of the back part of the mouth, swelling, wrinkling, ulceration, and even disorganization of the pituitous tunic of the nose in the places infested by the larvæ, are observed. The animal loses its strength, can hardly stand on its legs, falls into convulsions, and dies in a short time.

Young flocks are sometimes attacked by this plague, when they frequently graze near woods; and it is not unusual that a considerable number are tortured to death, although the larvæ fall out of themselves at the proper time, to undergo further transformations apart from the body of the sheep. When the head of a slaughtered sheep which has been attacked by these insects is closely examined, larger or smaller larvæ of the *Œstrus* will be found, according to the season of the year. These are at first perfectly white, and become later bronze-coloured, and furnished with brownish or blackish rings. We must observe that the bot makes the sheep turn round frequently, exactly as if they were infested with the hydatids, which occasion the disease called the gid.

The hydatid worm appears in lambs, much seldomer in yearlings, and still more rarely in full-grown sheep; it causes no defluxion from the nose, no symptoms of a disease, no sneezing, staggering, &c., but the sick animal is lost beyond remedy. On the contrary, in the disease caused by the sheep bot, the sheep in many cases cure themselves; the lambs are only attacked when they are out at pasture: and finally, the diseased state of the pituitous tunic of the nose is a clear sign that it is the sheep bot, and not the hydatid worm that affects them.

There are two remedies for relieving sheep from the sheep bots: viz. they are either taken out alive, which is effected by trepanning the skull, as for the hyatids, or an attempt is made by injections into the nostril to kill them, or to render them innocuous. Animal oil is employed for these injections, diluted with water. Chabert's proposal to make the sheep inhale the smoke of burnt leather or horn, is worth trying from its simplicity, though it is often far from successful. The operation of trepanning, and taking out the larvæ with pincers, even when successful, could only take place with the breeding stock. But it is much better not to put sheep in those pastures where the flies of the sheep-bot are found.

THE HORSE FLY, OR FOREST FLY. (*Hippobosca equina*, Linn.)

This fly lives chiefly on horses, but sometimes also attacks horned cattle and other mammalia. The male is scarcely so large as the house fly, the female is larger. The fore part of the body is depressed, the head triangular, the abdomen large and roundish: when it is not full of food, rather flat, and generally resembling the abdomen of a spider, hence it has also obtained the name of spider-fly. The thorax is speckled with buff, the other parts are

HIPPOBOSCA EQUINA.

brown; the blunt, membranous wings, lie crosswise over each other. The insect flies quickly, but in short flights, and makes use more of its feet than of its wings in moving. It prefers the abdomen of the animals, and attaches itself firmly to it.

The fecundated female Hippobosca equina swells by degrees to a very large size, and lays but a single egg, which is, in ordinary circumstances, not less in size than the abdomen of the mother. This egg is roundish, at first white, and contains for the first fourteen days nothing but milky juice. It afterwards becomes black, and the shell hard and shining like ebony. By degrees an insect is formed from the white juice, which escapes in due time as a perfect forest-fly, and never afterwards increases in size. When the egg is more closely inspected, its great resemblance to a nymph or pupa, will be discovered; also that it moves, and in the inside phenomena ensue which never take place in eggs. Small clouds appear incessantly to follow each other, and to move from one end to the other with a tolerably uniform motion.

These seeming clouds are nothing but the pupa, forming by degrees; therefore, reasoning from analogy, a kind of transformation must have already taken place whilst in the body of the mother. From the egg in the ovary of the mother, after fecundation by the male, is produced a larva, which feeds, attains its proper size, enters its pupa state in the body of the mother, and appears at its birth as a nymph.

The forest flies are produced, or to speak more correctly, increase very readily, on animals which have been neglected in point of cleanliness, and which from bad spoiled fodder, and hunger, are in bad condition. As they torment the animals very much, means of driving them away must be thought of. Picking off by hand is too troublesome. By the following remedy they can be got rid of in twenty-four hours' time. Of mineral earth 8 oz., lard 1 lb. made into a salve. Some of this salve is to be rubbed on here and there upon the hair, and worked in with a wisp of straw. After twenty-four hours the salve is to be washed off with warm water in which brown soap has been dissolved. Care must be taken for some days that the horse does not catch cold.

THE SHEEP TICK. (*Hippobosca ovina*, Linn.)

This singular animal, well known to the shepherds under the name of the sheep-tick, has no wings, nor does it ever attain them, yet it evidently belongs, from the conformation of its body, to the family Hippoboscidæ, as the bed-bug belongs to the tribe of the winged bugs. The fore part of its body is uncommonly small; the thick roundish abdomen, however, is proportionally very large, and generally in circumference about the size of a middling-sized pea. It sits sometimes on the skin of the sheep under the wool, and sucks itself full of blood. Its colour is pale red, the abdomen lighter, with an irregular white line on each side, and a red spot on the back.

This species also lays only one egg, which is the nymph or pupa, as in the forest-fly, and is fastened to the wool of the sheep. At first it is white, then brown, and finally the perfect insect escapes from it. As a remedy for this insect, Bock advises that the infested sheep should be washed with a decoction of the crushed or bruised leaves of the common maple.

Another method of diminishing or destroying the sheep tick is given in the Farmer's Magazine for November 1828, by a farmer in Suffolk. He advises the lambs to be put into a bath, by which the production of the sheep-tick will be prevented. The best time for this is July or August. Should it, however, have been neglected then, it is still time, if the weather permits, till Christmas. A pound of arsenic is boiled with a pound of soft soap and a pound of purified potash, in four gallons of water. The arsenic will be perfectly dissolved by the other ingredients. As soon as this is the case, the solution is thrown into a bathing tub sufficiently large to dip a sheep in, and forty gallons more water added to it; (the English gallon, beer measure, holds about $3\frac{1}{5}$ Vienna measure). In order to dip the sheep, its fore legs must be held by one man and its hind legs by another, so that the feet are held upwards. A man must also stand at the tub, to prevent the head being dipped, so that no poison may get into the ears, which would do it an injury. This man is provided with a sort of tressel, which he holds under the lamb as soon as it is withdrawn from the bath. He then squeezes the fleece with his hands, so that the greater part of the water sucked up by the fleece runs again into the tub.

In this way the above-named quantity may serve to dip one hundred moderate-sized lambs in. "I am aware," says the inventor, "how much the use of arsenic is in general objected to. It may be said, it spoils the skin, injures the wool, and might lead to the poisoning of the sheep; yet, from my own experience, I must declare that this remedy, which I always had applied with the greatest precaution under my own inspection, never produced bad, but rather very good effects. I must also observe, that one essential advantage of this proceeding consists in its protecting the lambs from the sheep bot fly, and consequently their larvæ, if it is done early enough."

THE BIRD SPIDER-FLY. (*Ornithomyia avicularia*, Meig.)

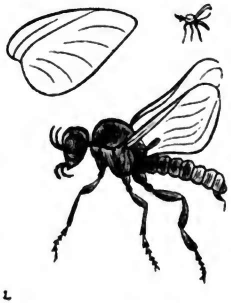
It is scarcely half as large as the forest fly, apple-green, flat above, and has small, transparent, black-veined wings. This insect is found both on large and small fowls. It clings firmly to the skin under the feathers, and is a great nuisance to birds from its greediness for blood. It is difficult to rid the birds of this insect, for it runs backwards and forwards so fast that it can scarcely be caught. When it has been taken from the bird, care must be taken, if it remains near, to prevent its return. It finds out the bird even when covered with the hand, and creeps unperceived again under the feathers. It possesses considerable tenacity of life; many that are thought to be killed when taken from the bird, fly back immediately. They leave the bird as soon as it is dead, as the head louse leaves a human corpse.

Cleanliness is the only remedy for this insect, and frequently sweeping and whitening the hen-house.

III.—INSECTS NOT PARASITICAL, BUT WHICH SOMETIMES ATTACK DOMESTIC ANIMALS.

(*Simulia Columbaschensis*, Schonb.)*

A SMALL fly, the length of which scarcely reaches one and a half lines, and its breadth half a line, is one of the greatest scourges of the Bannat of Temeswar, particulárly that part situated between Uypalanka and Ursowa, which borders on the Danube.



SIMULIA COLUMBASCHENSIS.

The time of this fly or gnat's appearance is the latter half of April and the beginning of the month of May. In many years it fills the atmosphere in such a manner, that it is impossible to breathe without swallowing a great number of them. Not unfrequently they appear in so dense a multitude as to be taken at a distance for a cloud, and in this form they are most to be feared. On the appearance of these clouds the herds instinctively leave their pastures and fly to the villages to take refuge in their stables, from these blood-thirsty insects.

Horses, oxen, and swine, generally suffer the most from them. When these flies attack any of the above-named animals, they select the tender, soft parts, free from hair. Hence they attach themselves mostly to the corners of the eyes, the mouth, the nostrils, and even creep into the ears and the inner nostrils, the throat and windpipe, &c., where they are sometimes found in animals killed by them, in thick layers.

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* This dreadful scourge does not exist in our country.

Men are no less exposed to the attacks of these scourges than domestic animals; but they can more readily drive them off, and by covering the face, secure themselves from the most dangerous consequences. Solitary examples also are not wanting where little children have been killed by them, when the mother, to pursue her work, has left her babe lying in the grass, or suspended in its swing to the branch of a tree, and staid away too long.

Every bite given by this insect to men or cattle causes a burning itching, and a very painful, hard, rapid swelling, which scarcely goes off in eight or ten days. Many of them, particularly when they are near together, cause a violent inflammatory fever, and, in sensitive bodies, cramps and convulsions.

Let us now describe in what manner this small gnat can kill such large animals in a few hours.

From the innumerable multitude of very painful and burning bites, arises a speedy swelling and inflammation, an insufferable irritation, and the cattle die, partly from the convulsions and inflammation caused by this extraordinary irritation, and are partly choked by the sudden swelling in the throat, and by the stopping up of the windpipe and œsophagus, occasioned by the multitude of these insects. Some animals die of this plague on their first being attacked, others after a few hours, and others the night after. Death is, however, not always the consequence of these fly-stings; they more frequently occasion tedious disorders among cattle: viz. loss of appetite, loss of milk among the cows, unfitness for field work among draught cattle, leanness among fattening cattle, untimely births among the pregnant cows, and other similar accidents, by each of which the farmer suffers no small loss, and the rearing of cattle in those quarters is very much impeded.

For a long time the appearance of this destructive gnat was a dark riddle to the inhabitants of the country. All sorts of conjectures were made about its origin. The inhabitants of the neighbourhood of Columbacz, in Servia, the native locality of these flies, assert that the caves in the limestone mountains, near the ancient castle of Columbacz, are their real birth-place, as they have been seen to issue from the mouths of these caves in the form of a thick smoke. This opinion is universal in the Bannat, and is particularly maintained by the Wallachians, who add, that the dragon killed by St. George is buried in this cave, and that these hurtful insects, as well as many other poisonous animals, are hatched in its jaws.

It has been found from closer observation that the insects are by no means hatched in these caves, but only fly into them in bad weather, and again burst forth in swarms when the weather is warm. Dr. Kömeves, formerly first physician in the Bannat of Temeswar, thought that, like the gall-flies, they were produced in the bladder-like excrescences which we see on the leaves of the beech. But these are the product of another fly which does no injury to other animals.

Dr. Schönbauer, late professor of natural history in Pesth, has very circumstantially explained the origin, and especially the whole history of this insect, in a treatise on the subject. According to his observations, and those of other naturalists, the fly passes its previous stages of egg, larva, and nymph, in water, and only leaves this element, like the gnats or midges, in its perfect state. Hence the watery and warm country about Columbacz appears peculiarly adapted for breeding this gnat.

Hungary is not its only birth-place; the same, or a species of fly resembling it in form and effects, is found even in Lapland, and is described by Linnæus under the name of *culex reptans*, [considered by Fabricius as identical.]

In the year 1830 there appeared, in the end of April and beginning of May, after a previous overflowing in the month of March, the same notorious *Simulia Columbaschensis* (as I was convinced by a close comparison), on the shores of the Marsh from its junction with the Danube as far as Hanna, in Austria, Hungary, and Moravia, and most plentifully in the countries lying on the banks exposed to the inundations. It attacked the cattle in the meadows, as in the Bannat, and the villages in that neighbourhood lost some hundreds of cattle, such as horses, cows, and swine.

The inhabitants make use of smoke as the most effectual means of warding off this terrible scourge from those countries, which are almost every year visited by it. For this purpose they collect large and longish heaps of straw, hay, foliage, dry dung, &c. both near their houses and also in the pastures, a brand is put in the middle, and the heap begins to burn slowly and causes thick smoke, which prevents the approach of the gnats. The cattle there, which know the effect of the smoke, fly eagerly to the smoke-heap as soon as they perceive a cloud of gnats, or when these gnats annoy them greatly, lay themselves down by the heap, and always on that side of it to which the smoke will be driven by the wind or current of air. Travellers make use, for this purpose, of torches made of rosin, pine wood, tow, and straw, which cause a great smoke, and which they carry close to themselves and their horses.

Although this remedy is the most effectual among those hitherto in use, it is not always sufficient to prevent the mischief done by these gnats. Hunger compels the cattle to leave the heaps occasionally, and every farmer has not always the means of keeping up the heaps for a length of time, from want of straw and foliage. Very often too the cattle in pastures are attacked by this gnat, when they the least expect it, and when they are very far from a smoking heap.

These are the reasons why so many cattle are killed by this gnat in certain seasons, notwithstanding this very effectual remedy is in general use in all those countries.

Many people wash their cattle with a decoction of wormwood, which is not entirely without effect, but not sufficient to keep off the gnats, particularly if it be not repeated every day, which very few of the farmers there would take the trouble to attend to.

Schönbauer, convinced by many years' observation of the insufficiency of this remedy, thought of another, which consists in a salve, with which the animals are to be smeared. This salve is prepared in the following manner: Take 2lbs. of tobacco leaves and boil them in 20lbs. of water, till the half is boiled away. This decoction, poured from the tobacco leaves, is then to be boiled in a broad earthen pan till it attains the consistency of honey. To this extract is added 1lb. of old lard, and half an ounce of petroleum oil. All these well mixed together compose this efficacious salve. The more petroleum oil and extract of tobacco are added, the stronger and more lasting are its effects. For want of petroleum, train oil may be used; but the effects are not so good as when petroleum oil is used.

The cattle are to be well smeared every third day with this salve, and on the tender parts, where there is not much hair, particularly the nose, mouth, ears, &c., and if this is done every third day, and the salve duly prepared, the cattle may be allowed to pasture in safety. The gnats settle upon the smeared cattle as well as on the others, but leave them almost immediately, and do not readily venture to sting them. "By this means," says M. Schönbauer, "I had the satisfaction of preserving for two years many cattle untouched by this plague. Every person to whom I communicated this remedy, and who applied it properly, found that it preserved his cattle healthy and uninjured, although they grazed among numbers which had suffered several attacks."

Schönbauer has introduced the following cure for the injury done by these flies with great success. Fomentations with warm milk on the bitten and swelled parts, warm poultices of linseed and water, sweet linseed oil, or fresh butter, which allay the burning very much, and prevent the swelling, when they are applied immediately to the injured part; lastly, warm softening baths. He caused blood to be let, if high fever and want of sleep, and, in men, delirium or too great sleepiness, took place. Internally he gave saltpetre, with cooling, softening drinks, such as a decoction of barley, bran, marsh-mallows, &c., particularly with an addition of honey and vinegar. If, in easily-excited individuals cramps and convulsions followed, he made use of opium very successfully after a previous letting of blood. Where the body was much inflated, emollient clysters were applied *.

IV.—INSECTS WHICH INJURE BEES.

Bees, a very important branch of economy in many countries, are often exposed to the marauding attacks of various animals, but particularly insects. We will communicate here the most important enemies of bees in the class of insects, with means of prevention and destruction, as they have been for the most part communicated to us in a very complete treatise by a practical apiarian, M. Stern, Canon of St. Florian.

The Bee Louse. (*Braula cæca*, Nitsch.)

Bees suffer sometimes from the larvæ of other insects, some few of which occasionally live as parasites upon them; they have, however, a parasite peculiar to themselves, a bee-louse, which Professor Nitsch, of Halle, was the first to describe circumstantially, in Germar's Magazine of Entomology, vol. iii. page 286.

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* M. Kollar, in conjunction with M. Pohl, has published an interesting memoir upon the obnoxious insects of Brazil, containing a great variety of particulars not introduced into the present work, which is intended more especially for the use of the residents of Austria. In the memoir above mentioned another species of simulium, and a species of culex are figured, both of which are as blood-thirsty as their transatlantic brethren. The name of musquito is by these authors applied to the former, but improperly, as it is more certainly used (especially in North America) for a species of culex, the simulium being termed the black fly.

The insect is about the size of a flea, and looks like a small spider, but is closely allied to the *Hippoboscæ.* The body is brown, shining, sparingly covered with short setose bristles, and firm to the touch. It has no eyes, but in their place the rudiments of four feelers. The last joint of the foot is not provided as usual with a claw, but with a cross row of numerous hooks.

According to M. Stern's observations, this parasite is chiefly found in populous hives, so that two, three, and even more are found on a bee.

A bee infested with a bee-louse, endeavours, but to no purpose, to get rid of such an unwished-for guest, till at last she creeps under a number of other bees, and rubs off the louse from her back, when it immediately betakes itself to the back of another bee. That the presence of this parasite causes pain to the bee, is apparent from the restlessness with which she runs out at the hole and back again, till she is completely tired. She even endeavours to assist a person who is taking the louse off her.

Though the bee-louse does not kill the bees, yet their infesting many of the workers does considerable injury to the hive, as these bees have not the same activity as the rest in collecting honey. The queen also is disturbed in her employment of egg-laying, when she is infested by them, so that the hive suffers in another way from impoverishment. It may even happen, that when many of these parasites infest a queen, (M. Stern once counted eleven of them), she must eventually perish. In winter the infested bees usually fall to the floor, and perish with cold and hunger.

Early in spring the bee-boards (*flugbreter*), particularly in hives infested with the bee-louse, should be turned, or cleaned from dirt; and it would be still better if the bees were freed from their troublesome guests in summer or autumn, by watching their appearance at the door of the hive, and with a long feather, rubbing them off the bee-louse, by stroking the bee from the head backwards over the back. The louse remains on the feather, where it can be easily killed. M. Stern often relieved a bee at a single stroke of from two to three of these torments, and once killed ninety-four of them in less than two hours.

SPIDERS.

Many sorts of spiders eagerly seek out bee-houses, where, if they are not prevented, they extend their nets, and cause the death and destruction of many of the bees: as we frequently see in neglected bee-houses, where their possessors only attend to them when their object is to obtain something from them. Spiders do not venture into the interior of the hive; they never dispute with a bee on the outside of their net, well knowing that they would be worsted; but if a bee gets into their net, they spin it up as they do other insects, and suck its juices.

Their nets should therefore be carefully destroyed all the year through, and the best plan of all is, they should be searched for in their hiding-places, where they lie concealed, and killed. They will generally be found in a corner or crevice of the woodwork of the bee-house.

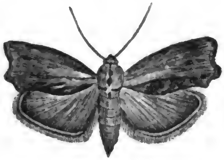
THE HONEY-COMB MOTH. (*Tinea cerella*, Fabr. *Galleria cereana*, Fabr.)

Apiarians have often to combat a very important enemy of their stock, which, although it does not feed on the honey, but only on the wax, yet, when too numerous, not unfrequently destroys a hive by the filth and stench which it occasions. This enemy is the caterpillar of a moth, called the wax-moth or honeycomb-moth, the wolf-moth, and, improperly, the honey-moth.

This moth is one of the larger species of the family of Tineidæ; its length is from five to seven lines, and its breadth, with extended wings, from ten to fourteen lines.

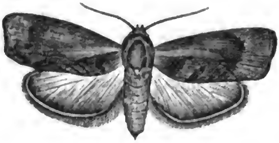
The male and female differ so much in size, colour, and form of their upper wings, that they were long considered as two separate species.

The male is considerably smaller than the female, his antennæ, head, and back, are clay-yellow, and on the back behind the scutellum rises a small, blackish brown tuft of hair, the point of which is white. The abdomen is yellowish brown, the feet yellowish gray, with lighter spots.

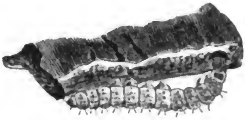


MALE.

The upper wings are broad, short, and obtuse; the fore border slightly curved, the fringe border lunated, notched inwardly, the inner border rather waving, with a small hollow exactly opposite the corner of the inner angle. The colour is dusty ash-gray, sometimes lighter and sometimes darker. From the base to the middle, there is a white slender band, on which are scattered single dark brown minute spots. Upon the fore border, and along the fringe border, are lines in the same direction, proceeding from a spotted band, which is angularly bent, faint, and often entirely wanting. The inner border is light yellowish for a considerable breadth from the base to the inner angle, with many purplish-brown, short, elevated, wool-like lines in the same direction; so that when the wings are closed above, an apparently furrowed surface will be formed. The fringes are jagged, brown and white at the points, and surrounded inwardly with a darker hair-like line. The under wings are light ash gray, and sometimes brownish gray, with lighter fringes edged with white, and a yellowish line for their inner boundary.



FEMALE.



CATERPILLAR TINEA CERELLA.

The female is much larger than the male, and is distinguished from him by a darker, rusty brown head and back. The abdomen is thick and club-shaped, furnished with a brownish gray ovipositor, and the feet of the same colour. The upper-wings are darker, obtuse, straight, almost rectangular, and a trace of the faint spotted band is rarely perceptible. The under wings are much lighter, white, but with a dark gray dusty border, and darker veins of the same colour, as far as the white fringes, which are surrounded with yellowish colour.

The caterpillar is cylindrically spindle-shaped, when fully grown from ten to twelve lines long, and two lines thick, dirty white, with scarcely visible brown single tubercles, emitting slender hairs. The head is chestnut brown, the back of the following segment rather darker, divided lengthwise by a whitish line; this line is sometimes continued indistinctly along the back. The tail-flap is not very brown. The belly and sixteen feet are bone coloured.

It prepares for itself, immediately on issuing from the egg, a web, or covered passage, with thick, strong threads, in which it lodges by day safe from the attacks of the bees, and only seeks its food, which consists of wax, at night, when the bees are at rest. At first, these caterpillars only live in the lower cells, but when they are bigger they ascend higher, lengthening their passage as they proceed; so that when there are many of them in a hive, it is entirely filled with these webs. The bees which are entangled in them and cannot get away, die. Three hundred caterpillars have been found in a hive. They attain their full size within three weeks, and are then ready for entering the pupa state. When this is the case, they make for themselves a much firmer and entirely closed web, either in the above-named passages, or in a concealed corner of the hive. In this web the caterpillar lives from ten to twenty-eight days unchanged, but is finally transformed into a brown pupa, out of which the moth appears in fourteen days. Those which become pupæ in autumn lie the whole winter in that state. There are two generations of them in a year.

The moth of the first generation appears in Spring, and that of the second in the beginning of July. The female lays her eggs at night in the cracks of the lower part of the hive, from which the young caterpillars find their way to the honeycomb.

There is but one sure method of clearing the beehives of this moth, and this consists in looking for and destroying the larvæ and pupæ. If the hives are examined only once a week for this purpose, any traces of covered passages will easily be perceived, and must be immediately removed, and destroyed with the caterpillars in them. The corners of the hive must also be closely examined, in case of cocoons being there, which must also be destroyed. A lighted candle is also recommended to be held before the hole of the bee-hive, that the moth flying out to the light may be burnt. But this is labour in vain, for the female does not leave the hive till she has laid her eggs; and it is only supernumerary males that perish in the flame*.

ANTS.

It is well known that ants are very intrusive and rapacious insects, and are particularly eager for sweets of all sorts; they are, therefore, usually found in the same places where bees seek their honey. Indeed they even visit the bee-hive themselves, and not satisfied with the honey alone, they sometimes even attack the young bees†.

On this account it is always a good thing to keep ants from bees. Particular care must be taken that the ants do not make their nests in the wood-work of the hives, as in that case nothing remains but transferring the bees to another.

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* Two other species of moths are also injurious to the hive bee,—one of these belongs to the same genus as that mentioned in the text, namely, the *Galleria alvearia*, or the honey-moth. The other is the gigantic death's-head-moth (*Acherontia atropos.*) It is only in the perfect state that the latter enters the hive.

† I lately brought with me from France a nest of the *Polistes gallica*, containing both the perfect wasps and some living larvæ, in the hopes of watching the development of these insects, but some common brown garden ants found their way into the vessel in which I had placed the nest, and ate all the larvæ out of the cells.

M. Stern bought a bee-hive, from which for two years he never could get a box (*Kästchen*) of honey, although all his other hives produced honey in both years. The bees worked very diligently in it, but when they had sealed up their honey as far as the third box, they were at a stand. As often as M. Stern came to this bee-house, he killed in this hive, particularly in the third box, many ants of the larger sort, yet not nearly so large as they are found in woods. The species was not mentioned.—They were seen running out and in at the small openings in the worm-eaten box, and when the holes were stopped up with grafting-wax or wood, the ants still appeared. Nothing remained but to cut out the worm-eaten third box, which had been so often visited by ants, and it then appeared that all the four sides were covered with innumerable passages, in which were thousands of ants and larvæ, which had for so long a time devoured what the bees had brought home. This rather singular instance shows, what attention ought to be paid to prevent ants from settling in the hives.

Wasps and Hornets.

Wasps injure bees, particularly in years favourable to their increase, by keeping them in a perpetual alarm from early in the morning till late in the evening, especially in Spring, and still more so in Autumn. They delight, in their eagerness for honey, to take up their abode in the inner covering of the bee-house, when they often endeavour to penetrate into the interior of the hive, and so commence a warfare with the bees who are carefully keeping watch, in which the more powerful wasp subdues many bees. Late in the season the bees, more delicate than wasps, withdraw into the middle of the hive among the honey-comb, on account of the cold evenings, so that the wasps, being less susceptible of cold, penetrate into the hives in the mornings and evenings, when they find the outlets unguarded. Here they run up the inner part, or entirely forsaken sides of the hive, to the honey, and take as much away with them as they can carry.

The best method of destroying them, is looking for their nests under the roof of the bee-houses, or in their neighbourhood, and destroying them. Many sorts of wasps, however, live in the earth, where their nests often attain an astonishing size; if such a fabric is discovered near a bee-house, it must be dug out, or destroyed with water.

Hornets are yet more dangerous to bees than wasps; sometimes they catch the bees on their homeward flight, sometimes take them directly from the outlets of the bee-house, fly away with them, and consume them entirely except the wings and feet. Like the wasps, they only attack bees singly.

The surest means of protecting bees from this dangerous enemy, is destroying the hornets. They make their nests in hollow trees, where they can easily be suffocated with lighted brimstone*.

BEES.

Bees are often the worst enemies to their own species, by the robberies they commit on other bees. They are born with the impulse to seek honey, and to take it wherever they can find it. If there is abundance in the meadows and woods, the bees are indefatigable in collecting it; but if there happens to be but few flowers during Spring and Autumn, they get into bad habits, and try to appropriate to themselves, by violence, the wealth of others, when it can be done with safety. Not only want of food in the open air, caused by unfavourable weather, but the unskilfulness and covetousness of man, often cause bees to become depredators. If they fly abroad to seek food in an unfavourable Spring, they must return home hungry; if they fly out late in the Autumn, and return, after a fruitless search, with empty stomachs, they live in the presentiment of future want; or if, as is often the case, they feel the pangs of hunger in the Spring, instead of starving, they attack, with force or artifice, their equals in another bee-house. On these occasions many, on both sides, find their death in the desperate contest.

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* M. Kollar has omitted two insects which are quite as obnoxious to the hive bee as any of the former. Of these, one is the *Philanthus diadema*, Fabr., (*apivorus*, Latr.), a species of sand-wasp, (*Cerceridæ*), which seizes upon the hive bees and deposits them in its underground cells in company with its eggs, and upon which the grubs feed when hatched. The other is the *Clerus alvearius*, a handsome beetle, the larvæ of which devour the larvæ of the bees in their cells. Both these insects are fortunately rare in this country.

If the attacked hive have a good queen, and be populous, the attacking party must give up the contest; but if the attacked party be without a queen, the dull dispirited people must yield to the aggressor. If it have a good queen, but is poor in people, and the aggressor on the contrary numerous, the latter can only get possession of the stores in the attacked hive, after the death of many bees on both sides. Bees are, therefore, very naturally led to become robbers, either by bad seasons, or by the avarice of their proprietor, if he, instead of feeding, plunders them. In these cases they are excited by hunger to go in search of honey; and if they find, in weak or queenless hives, high and wide outlets either not at all, or badly guarded; or if the proprietor when feeding his bees, or by any other oversight, has spilt honey in or about the bee-house, they are attracted by the smell of the honey to try to take a share in the food.

A robber-bee may be known immediately by its shining darker colour, as from its combats with other bees it has lost its hair; it betrays itself still more by its shyness. It seeks for another entrance into the interior of the hive besides the outlet, generally at the back of the hive; it hovers, restlessly, backwards and forwards, sometimes to the right and sometimes to the left of the hive, before it seeks an entrance into it.

Bees betray immediately the existence of robbers, even when there are no robber-bees near the bee-house, by receiving the bees of their own hive as they return in a warlike manner, by aiming at them with their two fore-feet, as if they were hands, to push them down on the resting-board.

In general, a watchful eye should be kept on every hive, the bees of which fly earlier in the morning, or later in the evening, than those of other hives, for they are or will be robbers.

When a hive has been vanquished, the robber-bees riot in it as long as there is anything to feed upon; and the remaining part of the vanquished hive unite themselves with the robbers. In the true knowledge of the causes which tempt bees to rob others, lies also the remedy, which must be made use of to prevent our bees robbing our neighbouring bee-houses, as well as those of strangers; and if robbing has already taken place, to abolish it as securely and with as little injury as possible to the robber-bees, which have often been innocently misled.

Above all, care must be taken, particularly in spring and autumn, to have healthy, populous hives in the bee-houses, well provided with the necessary quantity of honey. No more honey should be taken than the bees can conveniently spare.

A queenless hive should have a queen given to it, or be added to another that has a queen; and weak swarms should be strengthened by being united to others. The outlets of the hives, even when the swarms are large, should be kept very small in height and breadth in the beginning of spring and end of autumn, that the bees may the more easily defend themselves against their enemies; they should, indeed, only be fully opened when there is plenty of honey everywhere. Spilling honey at the time of feeding, or otherwise, should be carefully guarded against; as should feeding the bees, especially in the day-time, with tepid honey, as strange bees will probably be attracted by the smell, and may become partakers of it. Feeding bees with honey mixed with brandy, to make them more spirited, in order that they may attack and rob other hives, is particularly reprehensible; as, the bad intention apart, it may turn out to the disadvantage of the proprietor, if the owner of the plundered hive which they are thus excited to attack should kill the plunderers, or make prisoners of them, to distribute them among his own hives.

But what is to be done if a hive should be really attacked by robber-bees at a time when it is weak, or without a queen; and if the contraction of the outlet, so as to admit of the passage of only one bee, should be found to be of no use?—In this case, the first thing to be found out is whether the robbers are from other hives in the same garden, or from a strange bee-house. For this purpose, let the attacked hive be closed, but in such a manner as to leave air enough for the preservation of the bees, and place it thus closed, if possible, in a dark cool place. Then let an empty box, as nearly resembling the plundered hive as possible, be fixed in its place, and when the robbers come in search of honey into the empty box, let scraped chalk be strewed from above upon them, as they enter: flour should not be used, for being carried into the hive by the bees, it sours the honey, injures the young, and often causes them to become rotten. This should be borne in mind to prevent loss. A search must then be made among the other hives to see if any such whitened bees have entered the bee-house. If this is the case, the robbers are at once betrayed; if not, search must be made in the neighbours' bee-houses, and the robber-hive will soon be discovered by the bees powdered with chalk going into it. If the robber-hive belongs to the same proprietor, let a puff or two of smoke be blown into it, as well as into the plundered hive; then let them both be carefully closed, and put in a dark place. In their room put an empty hive, into which the bees, still flying about, will enter and pass the night. When all the bees that cannot get into their hive have entered the empty one, give them a puff or two of smoke, and leave them shut up till the next day, while, to pacify them, a little honey may be given them.

The following morning give egress to the bees in the plundered hive, after having placed it again in its old situation; as well as to the bees which entered the empty hive or box the evening before. In the evening, as soon as the bees have ceased flying, (for which purpose they should be intimidated towards evening by some puffs of smoke, to make them stay at home,) the outlet should be closed, and the hive removed to another place till the next day. The robber-hive must not be restored to its place till the evening, when the plundered bees are at rest; and the outlets may be opened that the bees in it may refresh themselves for a short time. The empty hive in which the robber-bees that could not get into their own dwelling were inclosed, should also be opened, that they may return to their home. When the bees in the robber-hive have again betaken themselves to rest, let the outlet be closed, and the hive put in a dark cool place till the evening of the next day. Let this be repeated three or four days in succession, and there will be an end of robbing; and even if some bees, while this is going forward, should come to the spot where the robbed hive stood, they will retire immediately, because they cannot find it.

If the robbers should venture a second time to attack the same or another hive, the surest means is to unite the attacked weak or queenless hive with another, or to transfer the robber-hive to another bee-house some miles distant.

If the robber-hive is in a neighbour's bee-house, the proprietor should be made acquainted with the case, that he may, as in duty bound, allow his robber-bees to be treated in the above manner, to cure them of their predatory habits, and that he may make good the injury they have caused, or sell the robber-hive at a reasonable price to the injured party, or, at least, that he may have it removed to a distant bee-house for some time.

If the proprietor of the robber-hive will not agree to any reasonable compensation, it is very easy for the injured bee-keeper to do justice to himself. Let the plundered hive be closed, and placed for some days in a cool place; then take a box, resembling it as much as possible exteriorly, and bore a hole below near the edge, somewhat in an upward direction, and fasten into it, in the inside of the box, a hollow tube of elder, about half an inch wide, and six inches long. If the plundered hive consisted of many boxes, one or more empty boxes may be placed upon the first, which must be closed with a lid, to deceive the robbers.

In this lower box some honey-comb is to be placed, or what is better, warm honey, with small pieces of wood laid over it, in order that the bees may not be drowned; by this means they will be more easily attracted by the smell; and for the same reason the entrance and the inside of the tube should be smeared with honey. In the box a small piece of wood is to be placed, partially covering the glass, so as to leave only a small space for the admission of light; the bees, satiated with honey, will seek in vain for egress where the light enters, but will not be able to find the only real outlet. In the evening, as much smoke is to be blown upon the prisoners as will stupify them; they are then to be shaken into a glass or jug, and covered with strong paper, and above that with a cover over the mouth of the jug. Then let the stopper be taken out of the upper board of the plundered hive, and a piece of paper be laid over the opening, and kept down by a small piece of wood or stone. The lid is then to be taken from the glass or jug, and if the bees have somewhat recovered from stupefaction, the vessel is to be turned down with the bees in it, on the paper inclosing them, and it is to be laid on the opening of the head-board of the hive, and both papers withdrawn, when the captives will soon go into the plundered hive. This plan is to be continued till the robbers cease their depredations. Then the plundered hive, together with its captives, is to be transferred to another bee-house some miles distant, and the bees suffered to fly. The robbers will remain with the bees of the plundered hive, and will then repay what they had stolen before.

Another, but desperate remedy, to save trouble and labour, would be to kill all the bees in the robber-hive; but this should never be done, for the bees that become marauders are generally the most active and industrious of the whole swarm. Robber bees should never be killed with poison, whether it is prepared expressly for them and their brood, or such as would be equally noxious to man. What terrible consequences might, in the latter case, ensue to individuals if they ate of the poisoned honey! On this account a severe penalty should, in every country, be inflicted in every instance of poisoning bees.

SECTION II.

INSECTS WHICH INJURE GRAIN IN A GROWING STATE, AND IN THE GRANARY; AND WHICH ARE INJURIOUS TO MEADOWS, FODDER, PLANTS, AND CULINARY VEGETABLES.

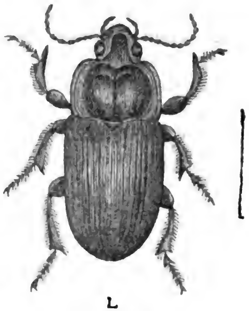
I.—INSECTS WHICH INJURE GRAIN.

The various sorts of grain are, from the moment when as seed they are committed to the earth, till they have attained their perfect maturity, exposed to the attacks of various sorts of insects. The farmer, who is entitled to expect a plentiful crop from the soil and favourable weather, often finds his hopes disappointed, without being able to guess at the cause. An insect, which escapes his notice from its minute size, as well as from the difficulty of finding out its abode, is at work destroying the fruit of his labours. The agriculturist who is unacquainted with the economy of insects, seeks in vain for the author of this destruction, and not unfrequently attributes it to creatures which, in reality, are his benefactors. Thus it happens that many birds are scared away from our fields, whose principal nourishment consists in insects; and that moles, which live entirely on the larvæ of insects lying in the ground, are hunted out and destroyed.

The enumeration of some of the principal insects which destroy grain, together with an explanation of their manner of life, may serve to point out to the farmer, when such cases occur, the situations in which he may search for his enemies; and either give him the means of diminishing or destroying them, or at least teach him whether the useless application of certain supposed infallible remedies, and unnecessary expenditure of time, may not be avoided, so that he may not increase the evil which has already been done.

THE GIBBOUS GROUND-BEETLE, *Carabus* (*Zabrus*) *gibbus*, Fabr.

This is a beetle which injures wheat, rye, and barley. In the year 1812 the larva of one of the ground-beetles caused great damage to the corn-fields near Halle. The society of naturalists in that city appointed a committee of its members to examine into the case on the spot, in order to discover the species of insect to which this larva belonged, and to devise proper means of destroying it. The history of the egg could not be discovered in the month of June, when the examination took place, yet we may conclude, from the observations communicated by a peasant, of his having found a whole heap of little caterpillars in a ball, that the eggs are laid together, and not singly, by the mother.



ZABRUS GIBBUS.
(The line indicates the natural length.)

The larvæ of the insect are, apparently, three years before they undergo their transformation, as half-grown larvæ and pupæ were found at the same time.

The length of the full-grown larva is rather more than an inch. It is flat and narrow, and nearly of equal width throughout. Its whole body consists of thirteen segments, the first of which forms the head, and the last the anal end. The head is very flatly pressed, armed with strong forceps, like mandibles, and on the upper side it has two indented lines, running lengthwise. Above the eyes are two short, straight, four-jointed slender antennæ, and the head is covered with single fine hairs. The second segment is rather quadrangular, larger than the others, brown above, and white below, where is placed the first pair of feet. The two following segments are broader than they are long, brown above, and below white, with a brown callous spot on each side, where the spiraculum or air-hole is situated; they bear the second and third pair of feet; single stiff hairs are also observed on them. The following segments are all of equal length, but diminish in breadth towards the tail. They are yellowish-white, beset with bristles at the sides. Above is situated a broad brown spot, rounded at the corners, and with a dot on each side. All these brown spots, or warts, consist of a thicker skin than the body, and touch each other lengthwise. At the lateral margins of the segment is placed a double row of similar brown longish warts, so that there are two warts on each segment, on each side.

On the underside, in the middle of each segment, there is a similar brown narrow, callous, slanting spot, and behind it are four of the same brown smaller spots lying in a slanting line; but the latter are wanting in the penultimate segment. The anal segment is small, and almost entirely brown; the extreme point projects, and over it is a protuberance with two three-jointed, hairy, short pointed horns. Along the back of the whole larvæ runs a transparent central line, through all the segments.

The following observations were made on the insect's mode of life. By day it lies upwards of six inches beneath the surface of the earth; it goes abroad in the evenings and nights, eats into the stem at the surface of the earth, and revels on the pith within. These insects were first observed in a wheat field, which they devastated; and although wheat was again sown, they destroyed it again. Afterwards they attacked rye, and subsequently barley.

None of this destruction was observed to extend to the other sorts of field-crops; on the contrary, the devastations of the insects were comparatively small in those fields where vetches or potatoes were cultivated with the wheat; and the wheat, rye, and barley-fields, lying behind vetch or potatofields, were not attacked. In a field which had been first sown with wheat, and destroyed, and again sown with wheat and vetches together, marks of the devastating powers of the insects on this second sowing, were observed, together with a number of pupæ, in the earth. The devastation first began in those fields which lay near pastures, in the neighbourhood of rape, and fallow and stubble-fields, and extended from them: as the ravages were greatest in the beginning of spring, the larvæ appeared to have retired to the pastures for their winter-quarters, and proceeded thence to attack the neighbouring fields. Their great numbers in fields lying near stubble and fallow-fields, is easily explained, as they are the offspring of those which, the year before, lived on the crops grown in these fields.

By digging in the ground near the infested crops, the commissioners found, in the month of July, an immense number of burrows, descending perpendicularly, (occasionally slightly curved,) to the depth of from six inches to two feet into the earth, and these burrows each ended in an oval smooth cavity, in which a curved pupa lay.

In this pupa the different parts of the body of the perfect insect were clearly to be distinguished, such as the head, thorax, and abdomen. The colour was a yellowish-white, and the eyes black. The head was rather quadrangular, with long projecting palpi, and incurved antennæ, which were rather shorter, and had the joints more compressed than in the perfect insect. The prothorax was almost quadrangular, rounded anteriorly at the sides, the head lying bent under it. The abdomen was more than twice the length of the prothorax and the incurved head, and it consisted of eleven * distinct segments, which diminished posteriorly to the last, which terminated in a triangle, and formed the anus. The segments, compared with each other, were nearly of the same length; the back was rather flat. Each segment

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* The prothorax, or first of the three thoracic segments, having only been described in the preceding paragraph, the mesothorax and metathorax (the two remaining thoracic segments) are here calculated, in conjunction with the nine true abdominal segments.

had several oblique wrinkles, and a transparent line posteriorly shortened, running along the middle. On the underside, was perceived the short, furrowed, transparent sternum, bent downwards; under which the middle and posterior legs lay inclosed. The fore-feet were fastened on the underside of the sternum, and all the parts were already perfectly formed, and nearly arrived at maturity. The whole pupa is extremely soft and sensitive, and is injured or killed by the slightest incautious touch.

The pupa state lasts only from three to four weeks. At the beginning of June the larvæ had become pupæ, and at the end of June and beginning of July the beetles began to appear. The perfect insect is seven lines long, and three lines broad, of a black or blackish-brown colour, and bears some resemblance in the form of its body to the meal-worm beetle (*Tenebrio molitor*). The body is much arched above, and faintly shining. The antennæ are nearly one-third of the length of the whole body; and they are thread-like and pitchy-brown. The head has a transverse indentation in front; and on each side it has another small hollow; it is rather large, smooth and shining. The eyes are of a dirty-white; the prothorax is quadrangular, broader than it is long, posteriorly cut off in a straight line, and narrower than in front; it is much arched, and almost smooth (that is, without punctures,) in front, but provided with slight transverse wrinkles, and much punctured towards the posterior border. The wing-cases are striped, and the hollow stripes dotted. The feet are pitchy-black.

The injury the larvæ of this insect caused in the neighbourhood of Halle was very considerable. Before the period of its transformation, twelve hides (about thirty acres each) of land, in the canton of Seeburg, were devastated, and its course did not end here. The perfect insect appeared in July, in enormous swarms, concealing itself in the day-time under stones and clods, and at night crawling up to the top of the straws, and eating the grains out of the ears; so that the fields which had escaped before, and those of the neighbouring parishes, fell a prey to them. Several of these beetles, enclosed in a box, fed for a considerable time on ears of corn*, and when these failed attacked each other†.

The Halle committee devised the following means of diminishing the number of these insects:—

1.—To adopt the best means for enabling country schoolmasters to make their scholars perfectly familiar with this insect, in order that they might be sent to catch it in their leisure hours. The common net, (a linen bag stretched on a hoop of strong wire, and thus forming a sort of net, such as is used in catching butterflies,) may also be stretched at night on the corn, and the insects feeding on the ears caught in it. In the day-time they must be looked for under stones and clods.

2.—To recommend the farmers, late in the autumn, when the first slight frosts set in, to plough those fields which have had crops of wheat, barley, and rye, as deeply as possible. Many larvæ which have by this time retired to their winter-quarters, will thus be turned up in a benumbed state, and will either be killed by the next frost, or devoured by the crows and other birds when they are in search of food. But this ploughing must be performed for many years successively; and by all the neighbouring farmers almost simultaneously, or it will not be efficacious.

3.—To strew those fields that have been sown in autumn thickly with peat ashes (when peat is to be had, and is used as fuel,) in spring; when the supervening rains will disengage the sulphuric acid, which will kill the insects.

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* Alfred Tulk, Esq. of Dover, has informed me that he succeeded, during the winter of 1837-8, in keeping several individuals of this species alive for many months in a box, by feeding them with corn.

† According to the account of this insect given by Germar, it appears that the *Zabrus gibbus* was accompanied in the proportion of about one-fourth by one of the species of cockchaffers (*Melolonthidæ*,) which Mr. Stephens supposed was the real cause of the mischief; and that the *Zabri* (which belong to the family of predaceous land-beetles, *Carabidæ*,) were not injurious; but, on the other hand, fed upon the *Melolonthæ*, and thus were beneficial. This opinion has, however, been fully disproved, by various direct observations detailed in the second number of my "*Introduction to the Modern Classification of Insects.*"

4.—To be careful not to injure the very useful crows and other birds which live on insects.

THE GERMAN OR FIELD COCKCHAFFER, *Melolontha agricola*, Fabr.

An insect injurious to the ears of wheat and rye. In the month of June, when the grains of wheat and rye are full grown, but still soft and juicy, an insect belonging to the order of beetles (*Melolontha agricola*, Fabr.), and nearly allied to the May-bug, does considerable damage to them in many seasons. This insect has almost a square abdomen, which is rather flattened; its whole length is six lines, and its breadth three lines. The colour of the wing-cases is mostly brown, but sometimes a small square spot is observed at their base, and another larger saddle-like spot of the same colour in their middle. The head and thorax are of a dark-green. The clypeus is turned up at the fore-edge, or forehead. The under side of the body and legs are black.

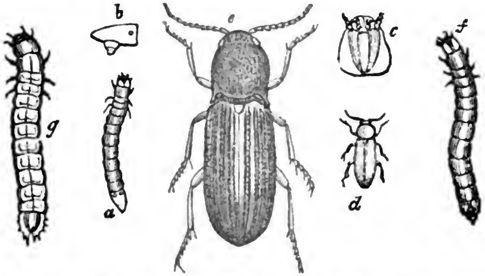
These insects are found sometimes singly and sometimes three or four together, sitting on the ears, and gnawing the still soft grains of rye, or of wheat, which is still more to their taste. I have found ears which had been robbed of the third part of their seed by this insect.

Whether the larva of this insect, (which, reasoning from analogy, lives in the earth;) injures the roots of the corn, or only feeds on manure, has not yet been discovered, and no means can be resorted to for destroying it, as it lives in concealment. Crows, moles, and field-mice, are its greatest enemies, and they should therefore be spared, when their numbers are not so great as to make them injurious.

The perfect insect can only be diminished and destroyed by picking it off the corn. Children may be employed for this purpose, and must collect the insects in bags. The insects must be crushed or destroyed by pouring hot water on them, and then given to poultry, which will become very fat by feeding on them. The hand-picking must take place early in the morning, while the dew is on the plants, as then the beetle hangs lazy and benumbed on the ears of corn.

The Lined Click-Beetle. *Elater lineatus*, Oliv., *Cataphagus*, Steph., or *Agriotes*, Esch. *lineatus,—Larva, the Wire-Worm.*.

A beetle particularly injurious to oats. The larva of this beetle (known in England under the name of the wire-worm), appears sometimes in great numbers, and devastates whole fields of corn, by attacking the roots. This is particularly the case with oats, when the leaves become yellow and die off. This larva is slender and linear, flat, shining, smooth, slightly hairy, and brown; the last ring of the body terminates in a toothed forceps *. It resembles the well-known meal-worm.



Larva of Elater segetis of Bjerkemder, *a*; under-side of the terminal segment of the body, *b*; head seen from beneath, *c*; perfect insect, natural size, *d*; magnified, *e*; larva of the true wire worm, *f*; the larva of ditto, as described by Bouché, *g* being another species.

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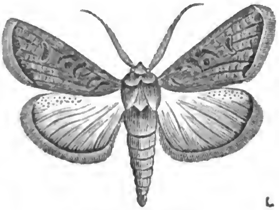
* There seems to be some confusion both here and in the writings of Bouché (*Naturgeschichte*, and *Garten Insecten*) as to the real larva of the Cataphagus Lineatus.—See my Article on the Wire Worm, in Loudon's *Gardener's Magazine*, No. 96, p. 115.

The beetle is blackish, with grey hairs: the feelers and legs are brownish yellow, and the wing-covers striped with grey.

It is hardly to be supposed that the proper food of the larvæ of these insects consists of healthy roots; and this appears the more evident as M. Bouché always found them only in vegetable manure, in those years when they were not numerous; so that he thinks they only attack the roots of grain, when they are very numerous, for want of their proper food. The best means of destroying them is to mow the oats, and plough up the ground frequently, when crows and other birds will pick up the larvæ.

The Winter, or Dart Moth. *Agrotis* (*Noctua*) *segetum*, Autor.

A moth that injures winter-grain. The caterpillar or larva of a moth, which, from its food in the larva state, is called the winter corn-moth, is one of the greatest enemies of autumn-sown corn. Fortunately for the Austrian farmer, this species seldom increases to such numbers in the neighbourhood of Vienna, as to cause any important injury; it is more plentiful, however, in northern Germany, Prussia, Poland, and Russia; and in the latter country it is so troublesome, that some time since a prize essay on the means of destroying it was advertised for by the Russian government in the public papers *.



AGROTIS SEGETUM.

This caterpillar attacks both the leaves and roots of the corn; by eating them off destroys the crop, and causes whole fields to be ploughed up. From many observations, the corn suffers most in rich soils in warm situations, and particularly in those fields which were early sown. It does not confine its ravages to corn alone, but attacks the roots of lettuce, turnips, and spinach; and on this account deserves no less the attention of the kitchen gardener than that of the farmer. Before we detail the means for destroying so injurious an insect, we shall describe its appearance and habits, as a knowledge of these will best contribute to render the proposed means effectual.

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* This insect also forms the subject of the London Entomological Society's prize essay for the year 1839.

The moth appears generally in the month of August in gardens and fields, sitting quietly on the ground in the day time, and flying about and pairing at night.

When at rest its wings are folded together flat over the body; it is then nearly an inch long, and half an inch wide. Its colours are dirty gray, and dark brown, or earth-colour, except on the under wings, which are covered as it sits, and which are sometimes whitish gray, sometimes cream-colour. On the upper wings a faint, blackish, ring-like mark is observed, and a cone-shaped spot on a wavy line, a kidney-shaped stain almost in the middle, and beyond this, towards the lower edge, two other wavy or notched transverse lines. The male is distinguished from the female by a thinner body and pectinated antennæ, while in the latter the antennæ are bristle-shaped.

Ten or fourteen days after the eggs are laid in the earth the young caterpillars are hatched, and consequently they appear about the end of August, or beginning of September. They eat at first the roots of various sorts of grasses, for want of corn; attacking the tender roots of the corn in September and October, when it begins to spring. At the approach of the cold weather they descend two or three inches deep into the earth, and prepare themselves an oval cavity, in which they pass the winter, without doing any injury. In the beginning of spring they leave their winter quarters, and feed again for a time on the roots of the corn and grass, without materially injuring the stronger plants. At the end of May or beginning of June they prepare to enter the pupa state, which change is accomplished in a small hollow in the earth. After four weeks the above-described moth bursts from a brown pupa. The caterpillar measures, when fully grown, an inch and a half in length, and is of the thickness of a strong quill, cylindrical, somewhat thinner towards the posterior end; it has six pectoral and ten ventral feet, the body is smooth, shining, and free from hair. Its colours are chiefly brown and dark gray, which alternate in broad stripes along the body, but which are at the same time intermingled in some degree. On the middle of the back a pale stripe stretches from the head to the other extremity, bordered on each side by a dark line. Near to this stripe on each segment are four faint black dots, the first pair of which approach closer together, and are so much smaller than the others, that they are sometimes scarcely visible.

Near the posterior pair, yellowish spots are generally seen. Below at the sides are the usual spiracula, or breathing holes, looking like black dots, and at the side of each there is another blackish dot. The feet are brownish gray. The arched, yellowish-brown head, is marked with two stripes, composed of small dark brown combined dots, running from the neck towards the mouth.

This description ought to be sufficient to point out the enemy when injury appears, and as soon as the winter corn is attacked. We must only further observe, that this caterpillar, like most other larvæ of night-moths, shuns daylight, and conceals itself in the day-time under clods of earth, stones, leaves, and even in the earth, and only comes forth from its hiding-place towards evening.

As the injury which these insects effect when they are very numerous is sometimes considerable, and many countries are threatened with famine by the destruction of the winter corn, numerous remedies have been proposed for eradicating them as soon as possible after they are discovered. We will give the most important of these remedies, and leave the choice of the most suitable to the judgment of the intelligent farmer.

It is beyond all doubt, that the quickest and surest way of attaining the end in view, would be to kill the moth at its birth. But this is a very difficult affair: for, not to mention that the moth does not fly by day, it has so dull and insignificant an appearance, that it is very difficult to be distinguished from the dark ploughed land where it sits. Various agriculturists have proposed to light fires at night on the corn fields, and to catch and destroy the moths as they fly into them. But it is very difficult, indeed quite impossible, to determine the exact day when the perfect insects are developed from the pupæ, as climate, temperature, and weather, together with various other causes, may either hasten or retard their development. We should therefore be obliged for many nights, indeed for many weeks in succession, to make attracting-fires, and to lie in wait for the moths as they appeared by degrees. In addition to the time and expense that this plan would require, the end would not be attained, for another reason,—it is usually the male insect that flies about, while the more unwieldy female sits quietly, and is sought out by the male at the time of pairing. Then the number of males is always considerably greater than that of females; so that how many soever might be caught of the former, there would still be enough left of both to continue the species.

As little can be effected against the pupa, as against the perfect insect, because the pupa is not exposed to view as in some butterflies, but lies in the earth, and that at a time when fields are not usually turned up.

As nothing useful can be effected against the perfect insect or its pupa, as we have already shown, nothing remains for us but to devise means whereby either the eggs or the young caterpillars may be destroyed before they have caused any considerable damage.

It has been observed, that the corn in those fields *which were early sown*, and in those that have a *strong warm soil*, usually suffers most from the insect. We will therefore endeavour to ascertain the reason of this circumstance. Guided by an unerring instinct, insects always search out for their progeny those places where their eggs will be most secure from danger, and the young brood at the moment of their birth furnished with the most suitable food. This moth, which is usually developed in the month of August, endeavours to lay its eggs on loose ground, and hence prefers those fields which were early ploughed. Here she lays her eggs in the soil, which, having been dried and loosened by the warmth of the sun, she can penetrate into without much exertion. After two, or at most three weeks, the young caterpillars creep out of the eggs, and find, if the fields have been sown early, their favourite nourishment in the tender roots and leaves of the young corn. If the sowing had been delayed for a few weeks, the greater part of the young caterpillars must have perished for want of food. Should, therefore, the moth appear in great numbers in autumn, sowing the fields later would certainly be one of the most approved means of destroying the brood. But why should *strong warm soils* be most infested with these insects? By the expression *strong warm soils* is here understood those that are manured with horse-dung. It is well known that horse-dung is the warmest of all kinds of manure. We know that many insects lay their eggs in places and on bodies which are in a certain stage of putrefaction, because such bodies are then in a state of fermentation, which is always accompanied with a considerable development of heat, by which the hatching of the larvæ, or maggots, will be accelerated. This hint is the more important to the agriculturist, as the observations that have been made actually show, that in the devastations made by this insect, those fields have suffered most that were manured with horse-dung. What we have already said on the habits of the insect, may suggest means of preventing its ravages; but there are other remedies which have been proposed in various quarters, which may appear more attractive to persons not acquainted with the habits of the insect. We will here describe and examine the best and most approved of these.

Some advise bitter herbs to be boiled in water, the juice to be mixed with salt, and the seed to be sprinkled with it before sowing; or that the seed should be soaked in this liquor for some time, and then dried. Salts, particularly saltpetre and rock salt, can do no injury, as they are used in other cases to hasten the germination and growth of corn. But it is, however, very doubtful whether the young caterpillars are deterred from attacking the young roots and the tender corn either by the salt coating of the grain, or the bitterness that may have penetrated into it. For, supposing the salt and the bitterness to have passed from the seed into the parts of the plant with these powers unchanged, this preparation of the seed must be rejected, for the very reason that it would make the future grain unfit for use.

The plan proposed by the Royal Academy of Sciences in Sweden, of mixing the wheat with slacked lime before sowing, to prevent the blight, as it has been termed, would answer the end better. It directs the eighth of a ton of lime to be taken to a ton of wheat. It is to be strewn over the wheat when spread out, and well beaten into it, that the seed may be thoroughly mixed with the lime. The mixture is then to be put into sacks tied firmly together, and laid in the barn under the straw, where it must remain three days to allow the wheat to become thoroughly heated. The sacks may then be opened, and the wheat sown in calm weather together with the lime.

This remedy may serve equally well to keep off the caterpillars from every sort of corn, particularly as it is recommended to sow the lime in the field at the same time as the wheat; in which case the caterpillars can hardly escape its corrosive qualities. Some agriculturists advise as a remedy against various insects that injure young plants, powdered gypsum, or inferior damaged tobacco, to be strewed on the field just as the plants begin to sprout, or ashes both before and after sowing. Either of these remedies might be effectual in preventing the caterpillars from attacking the crop, or in driving them away if already there.

It is more difficult to explain how hemp can operate in keeping off hurtful insects by being sown round the borders of a field, as some people advise. It certainly cannot be the smell of this plant which is hurtful to the insects, as many of them even feed on its leaves. The reason must therefore be that various birds, particularly sparrows, attracted by its seeds, and protected by its bushy growth, frequent the fields bordered with hemp, and contribute to the diminution of the hurtful insects there.

A remedy similar to this is proposed in the *Transactions of the Royal Academy of Sciences in Sweden*, with the assurance that many farmers have declared that they have protected their fields, sown with corn, from seed-eating caterpillars, only by sticking into the earth, here and there in the field, young fir-trees inverted, with the tops cut off. The effect of this remedy is there said to be so certain, that if the caterpillars were already in the field, it would cause them to disappear. However this may be, it is not easy to give a sufficient reason for this phenomenon.

From the universal law of nature, that the existence of one being depends upon the presence of another, it is evident that the caterpillar under consideration must have some natural enemies, to which it serves as food. But these natural enemies are chiefly the birds, those, in short, which we so often see following the plough, and diligently picking up the various sorts of larvæ which it has cast up. We mean the whole race of crows, the raven, hooded-crow, daw, and magpie. It is a mistake to suppose that they only eat grain, and injure the seed; they prefer insects and mice to grain; and they should rather be attracted by little pieces of meat thrown up and down on the field, than frightened away with stones and fire-arms.

Even mice and moles, when not too numerous, are rather useful than destructive guests to fields, for they destroy many caterpillars and pupæ concealed in the earth.

We have now arrived at the last, the most simple, and assuredly the most certain remedy of extirpating the noxious seed-eating caterpillars from the soil. This remedy consists in the farmer and his whole family repairing to the fields and collecting the caterpillars as soon as they appear. Similar plans have been suggested for various caterpillars that injure trees and forests, and they are acknowledged to be the best and the most to be relied on, by the greatest naturalists and most experienced agriculturists. The only question here is, how the hand-picking is to be set about, without spending time unnecessarily. A person unacquainted with the habits of our caterpillars, would seek for them in vain in his fields. As we have before observed, they cannot endure the light of the sun, and lie in the day-time under stones, clods, or buried in the earth. Stones and clods of earth, both large and small, must therefore be carefully turned up in search of the enemy. When they are changing their skins they come out of their lurking places, even in the day time, and can easily be gathered. Immediately after sunset they come out in great numbers, and feed greedily on the young corn. At this time, therefore, the work must be carried on with renewed vigour, and even till late at night, with lighted fir-torches, or lanterns. The collected caterpillars are best destroyed by throwing them into a hole and setting fire to brushwood over them *.

Though this method of getting rid of such troublesome guests costs much time and money, in consequence of the number of people that must be employed, yet the expense bears no proportion to that of a second cropping; particularly as we cannot even then be sure that the second sowing may not also be devoured by the remaining caterpillars. Besides, it is indispensably necessary in this case, as well as in the gathering of caterpillars injurious to fruit, that whole parishes unite in the work, that the labour of one individual may not be rendered useless by the neglect of another, because the caterpillars when they had eaten up everything on the neighbouring fields that were not cleared of them, would fall upon those that had been cleared†.

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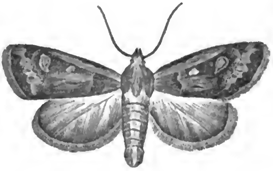
* This may be questioned if there are great numbers put into the same hole, as the lower ones would certainly burrow into the ground. It would be safer to crush them to death.

† The following paragraph, which applies equally well to the wire-worm, or the caterpillar of *Agrotis segetum,* appeared in the *West*

THE WHITE-LINE DART MOTH. *Noctua (Agrotis) tritici.* Autor.



AGROTIS TRITICI.

A moth injurious to buckwheat and autumn-sown grain. Count Von Beroldingen, who has contributed so many valuable papers to the *Transactions of the Imperial Agricultural Society of Vienna*, on the natural history of insects injurious to forest-trees, gives, in the second part of the fourth volume of that work (Vienna, 1836,) a comprehensive treatise on the devastations of a caterpillar on the buckwheat and autumn-sown grain in the corn fields of Marchfeld, in the year 1835.

We shall extract the essence of this paper, as far as it is necessary for our purpose; and refer the reader to the more

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Briton, a provincial paper, during the month of November, 1838:—"*Interesting to Farmers.*—Mr. George Pearce, of Pennare Goran, having been obliged to plough up a piece of ground, about an acre and a half, which he had sown with wheat, in consequence of the wire-worm having nearly consumed the whole, sowed it with turnips; but, finding that the worms had commenced their work of destruction on that crop, he employed boys to collect them, and at first gave them two-pence per hundred. Finding they would pick easily 600 per day, he reduced their allowances to three-halfpence per 100, and they have gathered the surprising number of 18,000, besides what Mr. Pearce and his servants picked up. By this means, Mr. Pearce has saved about one acre of turnips, which no doubt would have been completely destroyed. The boys soon found out, by the sickly appearance of the plant, when the enemy had taken possession of it, and having removed the mould and picked off the worms, they then returned the mould to its former position. As many as fifty worms have been taken from one turnip." Mr. Spence, to whom I am indebted for a copy of the above paragraph, adds, upon this fact, (so strikingly corroborative of the advantages resulting from hand-picking), that at three-halfpence per 100, the 18,000 cost 1*l.* 2*s.* 6*d.*; a sum well expended for saving an acre of turnips worth from 5*l.* to 7*l.*

circumstantial treatise in the above-named Transactions, for further particulars.

"The buckwheat (*Polygonum fagopyrum*) is, as is well known, only cultivated in sandy unmanured soils, as a summer crop, where oats and barley do not succeed, in the middle of the month of June of the second year of the three years' rotation crops.

"In the beginning of July, when the buckwheat had attained the height of six inches, bare spots appeared suddenly in the middle of the fields, which from day to day became larger and more numerous. On a close examination of these spots, a dark-gray, partly brownish caterpillar was found some inches deep in the earth; it was from one to one and a half inches long, and its thickness was that of a small quill. This creature after feeding, either at night or early in the morning, on the delicate shoots of the luxuriant buckwheat, passes the rest of the day in repose, or perhaps in gnawing at the roots of the plants in darkness in the earth. The devastations of these insects proceeded so rapidly, that within a week, more than half of the buckwheat fields were so completely devoured, that neither leaf, stem, nor root of the plants remained, and the fields were completely bare. Many proprietors tried to raise a fresh crop of buckwheat on the same ground, and partially succeeded, as the summer of 1835 happened to be particularly favourable to the ripening of that kind of grain. In the middle of the month of July several very heavy showers fell, and all the caterpillars disappeared. Apparently it was not so much this sudden change in the weather, as the period of their transformation into the pupa state having arrived, and the consequent cessation of their activity that caused their sudden disappearance.

"Although painfully sensitive to the loss they had sustained, the farmers consoled themselves when they saw the insect disappear, with the hope that it would not return, as until that period it had been unknown among them.

"In September the winter-grain was sown as usual. A great deal of rain having followed this sowing, the growth of the corn was greatly accelerated; and by the end of September the fields were rich in future promise, when all at once a second generation of those mischievous insects, which three months before had robbed the farmer of the greater part of his buckwheat crop, now threatened him with the more important loss of his bread-corn.

"The mischief spread with the same rapidity in the rye-fields as it had done in those of buckwheat; and in the space of a few days very considerable portions were so entirely laid waste, that not a trace was left of the young plants, which had sprung up very thickly from the seed. Some farmers resolved to sow their fields for the second time with rye; but those who attempted this too soon, experienced only a repetition of their loss.

"Unacquainted with the means of defence against the injuries of a caterpillar hitherto unknown to them, the farmers were obliged to yield to fate; it was, indeed, hardly practicable to make use of measures which, from their uncertainty, would have required too great an expenditure of time, money, and labour.

"It is of the utmost consequence that the intelligent agriculturist should always calculate whether the remedy does not exceed the evil, and the expenditure the gain. When, therefore, I was employed to endeavour to find a remedy for this evil, I contented myself at first only with the simple, but hitherto untried experiment, of surrounding the part of the field already attacked with a deep ploughed furrow, in addition to which, at fifteen or twenty feet distance, I made a second deep furrow.

"The increasing evil soon passed the first boundary, and would have attained the second line, had not the rain, which set in in the middle of October, and the cold weather which followed, apparently set more effectual bounds to the operations of these insects, than my experiment, the efficacy of which, at least by this trial, cannot be considered as proved.

"The weather had scarcely cleared up, when I had the bare corn-field again sown with rye. This was about the last week of October. In ploughing, the caterpillars were found numerous and alive in the furrows, but they had retired rather deeper into the earth than usual, and appeared less lively and active. A number of ravens, crows, and daws, the well-known autumnal birds, which arrived exactly at this period, and which were now looked upon as welcome guests, enjoyed a rich treat in these well-fed insects, and satisfied, at least in some degree, the wishes of the farmer, by their partial destruction of them.

"The severe cold which set in about the beginning of November, effectually prevented the further growth of the crop, and the question of the disappearance or continuance of this exceedingly noxious insect, was necessarily deferred till spring.

"About the time of my making these observations, I found a notice in the *Leipzig Gazette* that on the occasion of the meeting of the Saxon agriculturists and naturalists, at Freyberg, in Saxony, in June 1835 (the counsellor of the mining commission, and Professor Lampadius, presidents,) communications were made on the grass caterpillar (*grasraupe*), which had done so much injury in the eastern part of the mountains in the district, namely, Georgenthal, as well as at Töplitz, in Bohemia. As a proof of their extraordinary numbers, it was stated that Prince Clary had employed 200 men for four and a half days, to examine sixty bushels of mould, when they found in it twenty-three bushels of caterpillars, or four and a half millions.

"According to the same notice, five different remedies for the damage done by this caterpillar, (*Noctua graminis*, Linn. *Episema graminis*, Fabr., *Charæas graminis*, Steph.) were mentioned; some of them proposed, and others which had been put in practice.

"As I thought it probable that the caterpillar in question might be the same as one which had appeared nearly at the same time, and with the same effects, in Saxony and Bohemia, I requested Professor Lampadius to give me particular information on that insect, and above all, to be kind enough to make me acquainted with the remedies against it that had been proposed and put in practice. He accordingly very kindly transmitted to me all the papers read at the meeting of the Saxon agriculturists, and pointed out the statements of the high constable Von Könneritz as particularly interesting.

"The following were the remedies proposed against this destructive insect:—

"1.—Hand-picking.

"2.—Destroying them by birds.

"3.—Applying a strong dressing of lime to the land in the spring, or watering the fields and meadows with lime-water in damp weather, and (as Professor Lampadius advises as an experiment) strewing the ground with ashes, such as lye-ashes, coal, peat, and turf-ashes.

"4.—The proposal made by the Chamberlain Von Schönberg, of rolling the fields with heavy iron rollers, as is the custom in Styria and Carniola.

"5.—Lastly (according to the opinion of M. Teishmann), driving flocks of sheep over the field.

"M. Lampadius is of opinion that No. 1 would be too expensive; No. 2 neither sufficiently certain nor efficacious; and Nos. 3, 4, 5, deserving of further trial.—Hence it is evident, that hitherto nothing very satisfactory, as to the destruction of these very noxious caterpillars, has yet been devised; but he hopes that the united endeavours of agriculturists and scientific men will overcome, by degrees, this new enemy of our fields and meadows."

This is the essence of the report of the Count as to the appearance of this important enemy of agriculture, and its devastations in Bohemia and Saxony; to which may be added, that it was first supposed to be the larva of *Charæas graminis*, which had been before observed in these countries.

A closer inspection of some caterpillars that were sent to me, showed, however, that the caterpillar observed in Marchfeld belonged to quite a different moth. I regarded it as that of *Noctua segetum*, above described, or of *Noctua aquilina*, considered by me to be injurious to vines; till at length some moths produced from these caterpillars, clearly showed that it was the *Noctua tritici*, Linn., a moth very nearly allied to the last two species. It belongs, like these, to the genus *Agrotis*, formed by Treitschke, and is nearest allied to *A. aquilina* in colour, size, and habits, as well as in the time of its appearance.

With extended wings its greatest breadth is fourteen lines Vienna measure (1 inch 4-5 lines, *Stephens*); the length from the head to the points of the wings, eleven lines. When at rest the wings of this moth are folded together almost horizontally over the body. The ground colour of the whole insect, including the under wings, is earthy brown, or dark dusty grey. The antennæ are thread-shaped. On the back is rather a large tuft. The upper wings vary in marking and colour in an extraordinary manner, so that it is extremely difficult to determine the species from single specimens.

The specimens produced from our caterpillars were of an earthy brown colour on the upper wings, strewed with very small blackish spots. The larger round and kidney-shaped spots peculiar to the whole genus, are less apparent than usual; they are surrounded with dark brown, and have a slate-coloured eye. Below the round spot, the ordinary conical mark is perceptible, in the form of a brown very pointed angle. In our specimens no trace of the usual cross lines are visible, nor of the usual arrow line in the watered band. The anterior edge is spotted with black in patches; and at the outward edge, before the brownish fringes, is a row of black half-moon-shaped spots. The under wings are dirty-white, the veins and anterior border dusty-grey. The under side of the upper wings is dusty-grey, shining; the under side of the under wings corresponds with the upper side.

The caterpillar is upwards of an inch long, and of the thickness of a slender writing quill. On the back it is dirty olive-green, with a mixture of yellow. Each segment of the body has two transverse rows of blackish widely separated warts, each of which is provided with a short stiff hair. The head is brown, marked in the middle with a yellowish triangle. The abdomen and feet are dirty yellow, and the spiracula blackish. It lives in the day-time in the earth, and only comes out of its hole at night. When fully grown, in June or July, according to circumstances, it makes its cocoon in the earth, becoming a dark brown pupa. The moth is developed in the beginning of August, and begins immediately to lay eggs, from which, the same autumn, the young caterpillars are produced; and if they are very numerous, and located in corn fields, they may do very great damage to them that autumn, as well as in the following spring. This indeed is always the case, unless the young caterpillars have been partially destroyed, either by unfavourable weather in the winter, or by leaving their winter-quarters too early in spring.

In the instance mentioned by Count Von Beroldingen, no trace of these caterpillars was perceived in the following spring on the sown fields they had infested in the autumn; and in general in the following year, 1836, neither buckwheat nor autumn-sown fields were in the slightest degree attacked by this scourge.

It is not known whether this insect was driven back within its proper limits, so as to preserve an equilibrium in nature, by its natural enemies, or from the effects of the weather. In case of another visit from these caterpillars, we have only to refer the reader to what we have said with respect to diminishing and destroying the *Noctua segetum*, L.; not forgetting the suggestions for the destruction of the grass caterpillars, already given in this article.

BOTYS (*Pyralis*) SILACEALIS. TR.

A moth, the caterpillar of which is injurious to millet. We owe the natural history of this insect to M. Frederick Joseph Schmidt, merchant, in Laybach, a zealous entomologist, who transmitted a very detailed account of it, accompanied by an excellent drawing, to the Imperial Leopold-Caroline Academy of Naturalists, which was inserted in their *Transactions*, vol. xvii., part I., p. 477. According to Schmidt's observations, the moth lays her eggs in the month of June, on the leaves and stalks of the millet. The young caterpillar eats a way for itself immediately into the soft stem of the plant, where it feeds on the pith, thereby causing the millet to wither and die. When it has consumed the pith of one plant, it eats into another, proceeding always from the ear towards the root; and thus at the time of reaping the millet, the caterpillars being near the root, remain in the stubble.

Although the caterpillar is fully grown in autumn, it does not became a pupa till the ensuing spring. Schmidt did not obtain pupæ from the caterpillars he kept in the house till the month of June; they lay in the middle of the stem in cocoons, and became perfect insects on the 12th of July. The caterpillar is three quarters of an inch long, smooth, shining, dirty above, whitish beneath, with a blackish-brown head, and a yellowish, mixed with blackish-brown, scaly neck, through which a white line passes lengthwise. On each segment are three shining, blackish warts in a cross-line. From the fourth to the eleventh segment, behind the two (sometimes four) warts on the back, are also two minute black dots standing together, and forming an oblique square. On the twelfth segment the back warts run into each other. The feet are whitish, and the middle vein looks like a dark stripe. The pupa is light brown.

The moth with extended wings is nearly an inch broad; the female is larger than the male, and also differs in colour, so that it is necessary to describe both sexes separately.—*Male.* The ground colour of the head, back, and anterior wings is brownish-grey, varying into purplish; on which yellow ochre-coloured spots and markings appear in patches. The antennæ and palpi are grey, the former serrated, the latter short, porrected (elongated), and pointed. The shoulders are generally light yellow ochre. The abdomen is grey, with whitish rings, the anal tuft brown mixed with grey. On the fore wings there is usually, but not always, an indistinct yellow, notched, transverse line, followed in the middle of the wings by a longish, cornered, yellow spot, and a second transverse line, very wavy, and more or less flowing into the veins. There are many yellow dust-like dots just above the grey fringes. The under wings are fainter; they have an imperfect, broad, yellowish-white band, which sometimes only looks like a large middle spot.

The under side of all the wings is throughout dull brown, the markings on the upper side form a pale yellow band, and a middle spot of the same colour bordered with dark brown.

Female. Much rarer than the male, the yellow ochre is spread over its back and the whole of its upper wings; the transverse lines, on the contrary, are light brown; the two central spots are of the same colour. The border above the fringes is notched, watered-brown, and the fringes themselves are yellowish. The under wings have brownish-grey dust-like spots near the base; the broad faint middle band, as well as the border of the fringe, alternate yellowish light grey.

The injury caused by this caterpillar when it is very numerous, according to Schmidt's estimate, amounts to the twelfth, nay sometimes to the eighth of the whole crop, and he advises the following means of destroying them:—

As soon as the millet is reaped and carried, let the remaining stubble be pulled up, collected in heaps on the field and burnt, by which the caterpillars remaining in it, and those which have betaken themselves to their winter quarters near the roots, will at once be destroyed. The farmer can then use the ashes as manure; and, independently of the advantage which will accrue from the destruction of the caterpillars, he will have more benefit from the manure obtained, than he would have had from merely ploughing down the millet stubble.

This caterpillar has an important enemy in an ichneumon-fly, which M. Schmidt obtained from some pupæ.

THE CORN-MOTH (the Mottled Woollen Moth of Haworth). *Tinea granella*, Linn.

A moth injurious to grain laid up in magazines. Grain is not only exposed to the attacks of insects in the fields, but even in well-guarded granaries and airy lofts. The most dangerous of these enemies is the larva of a small moth named as above, and the caterpillar of which is also called the white *corn-worm.*

The perfect insect or moth measures from the head to the tips of the wings from six to seven lines, and when at rest the wings are laid over each other sloping at the sides like a roof, with the posterior border somewhat projecting. The body is brown, mixed with a little white on the back. The head has a thick tuft of white or yellowish-white hairs. The eyes are black, and the antennæ are composed of many round joints, thread-shaped, and brown. The upper wings are of the same breadth throughout; their ground is more or less white, spotted with dark brown and dusky dots of the same colour. The brown spots often run into each other by means of the brown scales strewed between, and vary much in form and size in different individuals, so that it is difficult to describe them with accuracy separately. The most decided and certain mark is a spot of the same colour at the base, followed by an almost square spot on the outer or anterior border; behind this in a slanting direction runs a band-shaped spot almost through the whole breadth of the wings. Behind this are two dots on the anterior border, and immediately above the tips of the wings a larger brown spot. The posterior border is furnished with long brown-and-white mottled fringes. The under wings are smaller and shorter, brownish, and furnished with long fringes at the posterior edge. The male and female are exactly alike in colour, and the latter when alive is only to be distinguished by having a thicker body.

This insect appears as a moth in May, June, and July.

Its habitat is in the buildings where grain is stored up; it sits at rest in the day-time, and only flies about at night. Immediately after pairing, which usually takes place a few hours after the moth issues from the pupa, the female lays one or two yellowish-white oval eggs on single grains of corn. They can only be distinguished by a strong magnifying-glass. A single female is capable of laying thirty eggs and upwards. From the statement of Dr. Hammerschmidt, the moth lays her eggs not only on grain laid up in storehouses, but even when it is still in sheaves in the field.

After a few days have elapsed, small white worms, maggots, or more properly speaking larvæ, proceed from the eggs, and immediately penetrate into the grain, carefully closing up the opening with their white roundish excrement, which they glue together by a fine web. When the single grain is no longer sufficient for their nourishment, the insects take another grain and unite it to the first by the same web, then add a third, fourth, and ultimately a great number together, thus forming themselves a house which serves at the same time for food; the spaces between the single grains are filled up with excrement. These larvæ are not, however, like many other larvæ of moths of this family, confined to the house; they often leave it, and run about in numbers over the corn, and cover its whole surface so completely with a thick whitish-grey web, that scarcely a grain can be seen. This generally happens when they are nearly full grown, and they appear by it to be endeavouring to protect themselves from the influence of the weather and the attacks of their enemies.

In their fully grown condition, the larvæ are from five to six lines long; their bodies, like those of the larvæ of other moths, are composed of thirteen segments, and provided with eight pair of feet, only the three anterior pairs of which, however, are real feet, the others being wart-like appendages (pro-legs) adapted for moving the body. The head is brownish-red, the body light ochre or buff; on the neck are two brown transverse stripes bent forwards.

In the month of August or September, the larva is fully grown and ready for its change. It now leaves the corn-heap and betakes itself to its winter quarters; that is, it enters the pupa state, and seeks for itself a safe and suitable place for undergoing its transformation. The cracks and fissures in the floor, in the walls, and in the roof of the granaries are full of larvæ at this time; they gnaw the wood into fine chips, from which they form themselves a cocoon or pupa-case in the same way as they previously formed their web. In this case the larva remains without taking any nourishment the whole winter. Not till March, April, or even May, according as the warm weather sets in, is it transformed into a brown pupa, the posterior part of which is much lighter than the other part, and the last segment of which is provided with two points. In about three weeks, the pupa pushes itself by means of these points nearly half out of its case, and in about half an hour afterwards the skin splits and the moth comes out.

From this description of the habits of the Corn Tinea, it will be easy to determine at what stage of its life and at what time it is destructive to granaries, and where the enemy is to be looked for and guarded against in the various seasons of the year. It is only in the summer months, May, June, July, and August, and sometimes in September, that the larvæ devour the different sorts of grain; and they attack rye, oats, and barley with the same zest as wheat. From September to May the larva is sought for in vain in the corn-heaps; it has retired into the cracks and fissures of the floor and walls, and moreover has concealed itself in its cocoon. It does not re-appear till April or May, and then in a very different form; namely, as a moth, which flutters about the heaps of store-corn, and deposits upon them the invisible germ of future destruction.

From these considerations the means which the agriculturist must employ to secure his grain from so dangerous an enemy, are clearly deducible. First of all the lofts, before the corn is placed in them, must be carefully examined to see whether the above-described pupæ are not lying hid in the openings between the boards of the floor, and the cracks and fissures of the walls or roof, and if any cocoons appear, they must be collected and burnt *.

The seasons at which this ought to be done are autumn and winter; for, during the other seasons of the year the cocoons, when found, are empty. The destruction of the moth, when it has become numerous, is much more troublesome, indeed almost impossible; for, from its smallness it escapes observation, and besides, sits concealed in its hiding-places during the day. The only remedy which could in this case be applied, supposing the insect has not been generated within the granary itself, consists in securing the air-holes and other apertures of the lofts with some material impervious to the moth, such as very thick gauze of wire or thread.

M. Hammerschmidt very justly observes, that fissures and cracks in corn-lofts must be prevented as much as possible, and when discovered, always filled up with fresh lime mortar. The walls and roof, if they are not smooth, are to be scraped, and by means of a composition of lime or gypsum, mixed with tan and cow-hair, to be washed and made smooth, so that no seam or crack may remain visible. By this means it will be difficult, or even impossible, for the larvæ to penetrate and settle in the corn-lofts, and thus all future inroads of the insect will be prevented.

Sprinkling the floor with a mixture of strong white-wine vinegar and salt before laying up the corn, is particularly to be recommended. Sweeping the floor and walls thoroughly before stowage, should also not be neglected; and the dust should be removed immediately, in order that the larvæ may not find their way back into the corn-heaps.

If the moth has laid her eggs on the grain, which she usually does in April and May, no other remedy remains but that of turning over the heaps frequently, in order that by the friction of the grains on each other, the larvæ may be killed. When the larvæ have grown to a sufficient size

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* This is rather a difficult mode of operation. I would suggest that the floors, and especially the parts which harbour the chrysalides of the moths, should be thoroughly washed and saturated with some strong solution.

to make themselves places of shelter, by uniting several grains together, as already described, turning the corn will be of comparatively little use; and the united grains must be dried, in order to destroy the caterpillars by the heat. Common salt is considered one of the best remedies of purifying the infested grain without rendering it unfit for use.

The excellent naturalist Rösel has found that the larvæ of the *Tinea granella* are killed by common salt, when it is mixed with the corn. The salt may either be mixed with the corn in a powdered state, or a solution of it may be sprinkled on the corn. M. Rösel also strongly recommends that granaries, before they are filled with corn, should be rubbed with a solution of salt; and at the time the moth usually lays her eggs, or even after she has laid them, that the corn-heaps should be covered with cloths soaked in a solution of salt.

Among the remedies which cause the immediate destruction of the larva or moth, garlic, tobacco-leaves, wormwood, hemp, rapeseed, hops, elder-flowers, turpentine, brimstone, &c., are enumerated by many agriculturists. But none of these remedies seem fully to answer the end in view, and are rather to be avoided, as they would communicate to the corn an unusual and often disagreeable flavour.

To prevent the larvæ from creeping into the side walls or the upper parts of the loft, it is advised to smear a part of the wall, about a foot wide round the inside of the corn-loft, with cart grease or tar, to which the larvæ would stick if they attempted to creep up the wall. But the corn acquires a disagreeeble smell from this substance, as well as from fumigation with brimstone, which is recommended to no purpose, as it only makes the larvæ conceal themselves deeper in the corn-heaps. The following remedy may be more successful:—Close to the infested corn-heap, let a smaller heap be made of a few pecks; then let the large heap be turned over by means of shovels, and thus endeavour to drive out the larvæ by disturbing them. Those expelled by this process will partly creep up the walls, and partly go into the small heap. They can easily be swept off the walls, and those which have taken refuge in the small heap may be killed by pouring warm water over them. Less advantage accrues from immersing the grain in water, as a short time is not sufficient for killing the larvæ, and a long continuance in water would be hurtful to the corn. Kiln-drying is better, and more adapted for destroying the larvæ. Several agriculturists have tried drying the corn in kilns with success; and no doubt can be entertained that this is the speediest and surest means of destroying the corn-moth, as it is killed at a temperature of 19 degrees of Réaumur. By this process, however, the corn loses its germinating power, and therefore cannot be applied to agricultural purposes. In performing this operation, it is necessary to produce the requisite degree of heat as speedily as possible, and to let the vapour, as it arises, escape through openings made for the purpose, otherwise a disagreeable smell might be communicated to the corn.

As the surest remedy, proved by repeated experiments, Dr. Hammerschmidt recommends ventilators, by means of which an artificial cold will be generated in the places where the corn is to be laid up. He has observed that the larvæ of the corn-moth can only live in a temperature of from 10° to 12° of Réaumur. If it sinks to 6°, or only to 8° above zero, they become inactive; and even die if this low degree of heat be continued for any length of time. To attain this result, small windows should be made near the floors of the barns and lofts, and in all directions; by means of which a sufficient current of air will be preserved in these places.

This end is still more easily attained by following the contrivance communicated by M. Hammerschmidt. Tin tubes are to be introduced into the closed windows of the loft; and one end of each tube is to be stuck into the corn-heap. A communication will then be formed between the internal heated air of the loft and the cooler external air, and a draught will be created which will considerably diminish the temperature of the heap. The same end will be obtained, continues Dr. Hammerschmidt, by introducing tubes into the floor of the granary, so as to project nearly a foot above it, with a covering at the top of each, pierced like a fine sieve. The corn is to be thrown between and over these tubes, and will be cooled by the draught of air which they create.

To prevent the moth from laying her eggs on the corn in the field, M. Hammerschmidt recommends the corn to be cut at the proper time, and not allowed to lie too long in sheaves. The injury done by the moth is also said to be prevented by sowing the seed deeper than usual in the ground. The experiments tried for this purpose yielded the definite result that when the larva was sown with the infested corn, and became a pupa in the earth, the moth, when it came forth, easily made its way through the earth, when the larva had not been buried more than about an inch; whereas, when the larva had been buried two or three inches deep, very few moths were able to struggle to the surface, and these only in a weak and languid state.

Bats and spiders are the principal natural enemies of the corn-moth. The former feed upon all sorts of insects which fly about in the evening, and no doubt destroy a great many of those small moths which live, as it were, under the same roof with them. Spiders spread their nets in corners, and before the doors and windows of buildings, to catch and prey upon small insects. Both kinds of creatures deserve, therefore, to be spared, rather than persecuted and destroyed, as is so frequently the case. The grey and yellow wagtails, and other small birds, which feed on insects, Dr. Hammerschmidt recommends to be allowed to fly about in corn-lofts, and to be provided at the same time with a sufficiency of water. The excrement of the birds is not nearly so injurious to the corn as the filth of the larvæ, and could be removed by the winnowing-machine*.

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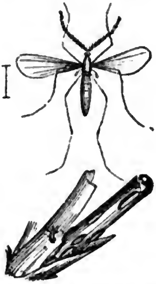
* THE CORN WEEVIL. (*Calandra granaria*, Clairville. *Curculio granaria*, Linn.)

THIS extremely injurious beetle having been omitted, probably by accident, in the original work, I have thought it proper (in order that so destructive a creature should not be overlooked nor confounded with the corn moth) to introduce it in a note in this place. The perfect insect is of small size, linear shape, with a narrow rostrum, and with the elytra marked by impressed lines of dots. The female deposits her eggs upon corn in granaries, and the young larva immediately bur-

THE HESSIAN FLY. *Cecidomyia destructor.* Say.

A small midge injurious to wheat. This minute insect, of the order of two-winged flies, *Diptera*, Linn., has already done considerable damage to wheat in North America, and occasioned dearth and famine by its devastations.

The North Americans call this fly the Hessian fly, because they erroneously suppose that it was introduced in straw with the Hessian troops, during the American war. This insect has also appeared in England and spread terror among the farmers *. In Austria this dangerous enemy of wheat was long unknown; or, if it did exist, the injury it caused was not sufficiently important to attract the attention of the agriculturist.



CECIDOMYIA DESTRUCTOR.

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rows into the grain, of which it eats the interior. It is sometimes exceedingly abundant in old granaries. Various plans have been suggested for its destruction, amongst which that stated by the late W. Mills, Esquire, in a short memoir published in the first volume of the Transactions of the Entomological Society of London, deserves especial notice. This gentleman found that "a heat of 110 degrees Fahrenheit did not prevent the development of the insect, whilst from 130 to 140 degrees killed them. A gentleman of the name of Wilkinson, in Madeira, has now established a heated room with hot-water pipes, in which he receives as many as 800 bags of wheat at a time; these become heated through at 135 degrees, and the wheat, when re-sifted, is perfectly cleansed from these noxious insects, and makes quite as good bread as before." Perfect ventilation and a constant shifting of the grain are great preservatives, and have been adopted as the principles for the construction of a machine for the preservation of grain, by M. Vallery, a French gentleman, a model of which was last year submitted to a committee of the Académie des Sciences, and of which a notice has been lately published in the *Athenæum.*

* M. Kollar has here adopted the mistaken opinion, at one time entertained, that a fly which did much damage to growing wheat in England at the beginning of the present century, was identical with the Hessian fly, Cecidomyia. The English insect is known to be quite distinct, being the Chlorops pumilionis.—See my Article on Wheat Flies, in the *Gardener's Magazine*, No. 87, July 1837.

It was only in the autumn of 1833 that complaints were made that the wheat on the estates of his Imperial Highness the Archduke Charles, at Altenburg, in Hungary, were considerably injured by an unknown insect. The account forwarded to the archducal office was as follows:

"Till the end of May the wheat was in excellent condition, but about the commencement of June the ears began to hang down and the stems to bend, and in a few days patches appeared in different parts of the fields which were of rather poorer soil than the others, with the plants entangled and matted together, as though lodged by heavy rains. This singular appearance was at first supposed to be the effect of high winds; but it was found to spread in fine calm warm days, from the poor soils to those richer, and finally to the best land, thus blighting our fairest hopes. More than two-thirds of the straw was lodged in less than a week; and the heavy rains which fell during the latter half of June, so fully completed the work of destruction, that the wheat-fields looked as if herds of cattle had gone over them.

"The cause of this damage was sought for, and we soon discovered, at the crown of the root of each of the wheat plants, or at the first joint within the sheath of the leaf, whole clusters of pupæ of an unknown insect. Those plants, the roots of which had been attacked, died off; and the spot to which the insects had fastened themselves on the still soft straw within the sheath of the leaf, was found to be brown, withered, and tough, yet without any apparent wound. The straw which had become lodged, produced small ears, with few and imperfect grains, which ripened with difficulty, and the straw was twisted, and of a very inferior quality."

A similar report was made from Marchfeld, by Baron Von Menninger, agricultural director of the Duke of Saxe Coburg. "In the fields of Weikendorf, and other neighbouring localities, caterpillars were found which had devastated whole fields. These caterpillars had their first abode near the ground in the first joint of the straw, where they were found in whole families in a sort of nest. The largest were about the length of two lines. Their colour was pale green, with a small black dot above. Some, generally the strongest individuals, penetrated higher into the tube of the straw; which they robbed of the sap rising up from the roots. The straw in consequence became dry at the first joint, and fell over or leaned on its neighbour.

The upper part of the straw received its nourishment from the atmosphere alone, and the ears formed; but they continued in a sickly condition, and could only produce small shrivelled grains. The life of the caterpillars appeared to be from about twenty-four to thirty days. As the straw ripened, the insects changed their colour into a brownish hue, shrivelled up, and finally disappeared.

"It has not been observed that these insects were most abundant in any particular situation or disposition of the ground. They appeared in as great numbers on elevated ground, as in those fields that lie low; and were not more numerous in those having a southern exposure than on those that open to the north. Neither had a rich or less copious manuring any influence on them."

In both accounts only the larva and the pupa are mentioned, and the perfect insect is never introduced. By means of the Archducal Councillor, Chevalier von Kleyle, I obtained some wheat straw that had been destroyed by these insects, in which many of the brown pupæ were found. I opened the pupa-case*, and was able to determine with great probability, partly from the form of the pupa, and partly from the unchanged caterpillar in the pupa-case, that it must be a small fly. I only ascertained this from the minute description and drawing of the insect from Mr. Thomas Say, in a North American Journal*, in which a stem of wheat, with the pupæ within it, is exactly represented as I have seen our wheat. Mr. Say has also observed the perfect insect, and had it drawn: he calls it *Cecidomyia destructor* †.

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* By the kindness of M. Alexander Lefebvre, late Secretary to the Entomological Society of Paris, I possess specimens of this obnoxious insect still in the straw near the roots, and which he had received from Dr. Hammerschmidt himself. From what has hitherto been observed of the transformations of the Cecidomyia, the pupa state is naked and not enclosed in a case, agreeing in this respect with the rest of the Tipulidæ. The insects which I possess are enclosed in a leathery case, and on opening them I discovered the larvæ shrivelled up and dead. If there is not some mistake in the observations which have been made as to the species, it is certainly a curious circumstance that these insects should form cases which have more the appearance of the coarctate pupa of the other diptera.

After the lapse of several weeks, on closely examining the box in which I had preserved these pupæ, I found a single specimen of the same fly. It is extremely tender and small, and is scarcely the size of a common gnat. Its body is covered with short black hairs. The *thorax* is much arched, smooth, and shining. The *scutellum* projecting, rounded posteriorly; the breast sometimes golden yellow; the abdomen brownish; the wings blackish; the golden yellow of the base is continued sometimes to the veins, where it appears lighter, and disappears by degrees about the middle. The halteres are yellowish white; the legs golden yellow at the base of the thigh. The female has a black streak on the abdomen. The larva is, according to Say, spindle-shaped, and whitish; the posterior end suddenly diminished; the head bent inwards, and transparent above. A short green line is remarked within, which is the intestinal canal. It is dirty white below; in younger specimens this colouring appears like nine spots on each side, and has a row of still smaller spots in the middle. When the larvæ are fully grown, they unite in regular cross segments round the wheat; they are then provided with very small hooks or notches towards the head: when taken from the straw they are immovable. Their length is three-twentieths of an inch, and their breadth one-twentieth of an inch. The pupa, or rather the pupa case, resembles the full-grown larva, but is dark reddish brown, and entirely without motion.

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* *Journal of the Academy of Natural Sciences of Philadelphia*, Vol. i. Part I. 1817, page 45; Plate 3, fig. 1-3, by Thom. Say. *Magazine of Natural History*, Vol. 1. (Kirby).—See also my Article, "Cecidomyia," in the *British Cyclopædia of Natural History*.

† It is perhaps questionable whether the North American insect described by Say, be identical with that here noticed, although their habits appear the same.

The perfect insect, according to Say, appears in June, and perhaps later; the female lays her eggs from one to eight in number, in the autumn, by means of an ovipositor between the sheath of the leaf nearest the root and the stem, where the young larvæ, as soon as they are hatched, find their nourishment. Here the larvæ are said to pass the winter with their heads turned downwards. The injury which these insects occasion, is of course not observed till the wheat has grown higher.

The natural enemy of this wheat-fly is an ichneumon-like insect, still smaller than the fly itself, named by Say *Ceraphron destructor**. This small insect is generally so numerous, that but few of the larvæ of the wheat-fly attain the period of their transformation. I also found the greater number of pupæ of the Hessian fly full of these parasites, which enabled me to make a very consoling prophecy for the next year; which was perfectly fulfilled, as no further complaints were heard on the subject from that neighbourhood.

The remedies which reason suggests should be applied on the reappearance of these insects, are found in the economy of the insect itself. The perfect insect is too small for us to pursue it, and it is equally difficult to effect anything with regard to its eggs and young larvæ in the autumn and winter, as at that time no certain sign of their existence is perceptible. It is only when the wheat has produced ears, that the presence of these larvæ or pupæ can be detected by the falling down of single stalks; but even at this period few farmers would be willing to sacrifice the rest of the harvest to destroy the enemy. The only practicable mode of destroying the insect is therefore to wait till the corn is reaped, and then to burn the stubble in which the pupæ lie concealed. If it should be impossible to do this, nothing remains but to sow the fields next year with any other grain but wheat; indeed not to sow wheat anywhere near them, that the flies may not carry their eggs there.

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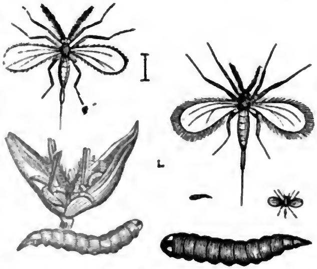
* This insect is not a Ceraphron, but belongs to the family Chalcididæ, and is probably a Pteromalas.

The Wheat Midge. (*Tipula tritici*, Kirby. *Cecidomyia tritici*, Latr.)

Another small species of midge, injurious to wheat. When the wheat is in blossom, it is sometimes attacked by a small fly of an orange yellow colour, which lays its eggs by means of a long retractile ovipositor, in the middle of the blossom. When the eggs are hatched, the larvæ prevent the fructification of the grains, probably by eating the pollen, and thus frequently destroy some part of the harvest. The perfect insect has a distant resemblance to the common midge, but is smaller, being scarcely a line long. The body is orange-yellow, the wings clear and transparent like water, and hairy at the edges; the eyes are black, the antennæ necklace-shaped, longer than the thorax, and the feet rather long.



CECIDOMYIA TRITICI.

The larvæ jump on being touched, they have no feet, are of a citron colour, wrinkled or warty at the side edges, the head terminates in a point, and the posterior end is truncated: the pupa is slender, pointed at both ends, and of a reddish colour.

The extraordinary smallness of this insect both in its larva and perfect state, with the circumstance that the destruction of the wheat takes place when it is in blossom, and that not all the ears on one and the same field are attacked, allows of but little that can be effected by human aid against this enemy of grain. The safest and almost only certain means of diminishing such an evil for the next year, consists in not sowing wheat again on the same field, nor in its neighbourhood; for in all probability, the pupæ lie in the earth*, and will only become flies next year at the season when the corn is in blossom. Fortunately nature has in this case provided another still smaller parasitic insect allied to the family of the Ichneumons, to keep the midge also within its proper bounds. Kirby, a celebrated English naturalist, who first made us acquainted with the natural history of this insect, calls the parasite *Ichneumon Tipulæ* †. Whether this fly has already been observed in other countries of Europe besides England, is unknown to me; I have, however, thought it necessary to call attention to it in case such an event should occur, that people might know how to deal with it.

The Barley Midge. *Tipula cerealis.* Sauter.

A midge particularly injurious to barley, and spelt (a kind of dwarf wheat). In the years 1813 and 1816 the larva of a small species of the family Tipulidæ was greatly dreaded from its destruction of corn-fields, particularly barley and spelt, in many parts of the grand-duchy of Baden. This larva is vermilion-coloured, and is one, or at most one and a half lines long; it appears in May and June, lives gregariously between the leaf-sheath and the stalk, and eats the straw, which in consequence becomes warty, notched, and crooked, and afterwards dies. The larva is without feet, and consists of nine segments, including those containing the head and tail, both of which it can retract and extend. Between each ring of the body at both sides, there are small hooks bent forwards. When the larvæ are fully grown, they go into the ground to undergo their transformation. The duration of the life of the perfect insect is very short, being only a few hours; but the period of its transformation appears to last two or three years. The perfect insect is brownish-red, and the two wings silver-coloured; the antennæ are bristle-shaped, longer than the body, and consist of thirteen joints.

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* According to M. Gorrie (*Mag. Nat. Hist.* Sept. 1829, p. 324), 'all the larvæ have quitted the ears of wheat, and descended to the earth by the first of August; going into the ground to about the depth of half an inch, where it is probable that they pass the winter in the pupa state.

† This insect is a species of the genus Platygaster of Latreille, belonging to the family Proctotrupidæ.

The author of the treatise on this insect, Dr. John Nep. Sauter, of the grand-duchy of Baden, proposes, as the best means of destroying it, mowing all the fields at the time when the period of development of the perfect insect is over, in order to kill the eggs and the young brood which has perhaps been hatched.

As we have not yet observed this insect in our neighbourhood, we extract this account from *Germar's Magazine of Entomology*, and only observe that perhaps the same, or a nearly allied insect, did great damage to the oats in Styria and Carinthia several years ago. M. Councillor Burger, who communicated this information to us, has learnt from the commission appointed to inquire into the history of this insect, that it was a fly, belonging to the family Tipulidæ. The devastation of the oat-fields was repeated several years in succession, and the insect disappeared at last without any remedy being applied. Mowing down the infested oats, at the period when the insect was in its larva state, had probably prevented further injury.

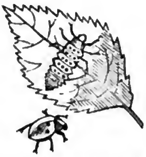
II.—INSECTS INJURIOUS TO MEADOWS.

Most of the insects that choose the various sorts of corn for their food, do not reject the other sorts of grasses in the meadows. The herbage of the meadows has also often peculiar enemies, which it is very difficult to find out and destroy. In most cases, the meadows suffer from the roots of the grass plants being injured, which is chiefly occasioned by the larvæ of various species of cockchafers (*Melolontha* Fabr.) living in the earth: such as *M. aprilina*, *M. solstitialis*, *M. æquinoctialis*, *M. horticola*, &c.

When bare spots are seen on meadows, we may be sure that the larvæ of the cockchafer are there carrying on their work of destruction. But the large swarms of those smaller species of cockchafers which we see flying about towards evening in the meadows in the spring, and at the beginning of summer; and the round holes which we frequently find in meadows, through which they had crept out of the earth, clearly show that they had passed the first period of their life there, and at the expense of the herbage. Breaking up the ground in warm weather when the larvæ are not deep under the surface, is the surest means of diminishing and destroying them. Birds, and particularly crows, of which they are a favourite food, will then easily get at them. Pigs may also be driven on these meadows.

THE UNSPOTTED LADY-BIRD. *Coccinella impunctata*, Fabr.

An insect injurious to many of the artificial grasses. According to the observations of Dr. Hammerschmidt, the larvæ of a small beetle, the unspotted lady-bird, or lady-cow (*Coccinella impunctata*), sometimes injure various sorts of herbage adapted for fodder*. It has been observed on the common tare, sainfoin, and the different sorts of clover. M. Heeger ascribes to this larva the destruction of the lucern (*Medicago sativa*, L.†) It only consumes the softer parts of the leaf, and rejects the veins.



COCCINELLA, AND ITS LARVA.

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* The species of Coccinellidæ are ordinarily in the larva state serviceable in destroying the aphides upon which they feed both in the larva and perfect states, and hitherto no species has been recorded to be herbivorous; but M. Audouin lately directed my attention to the economy of Coccinella Argus, found near Paris, and which we observed feeding upon the leaves of the common bryonia at Sèvres, near Paris.

† Clover seed is often attacked by several small species of insects belonging to the genus Apion of Herbst, so that when the farmer expects to reap considerable profit, he finds nothing but empty husks. The yellow-thighed Apion (*A. flavifemoratum*) feeds upon the seeds of the purple clover, and the yellow-spotted apion (*A. flavipes*) upon white and Dutch clover.

This larva is only two lines long, yellowish-white, with single green spots, and the upper side of the body covered with prickles. Its transformation takes place on the leaves. The pupa is light yellow, covered with minute hairs of the same colour.

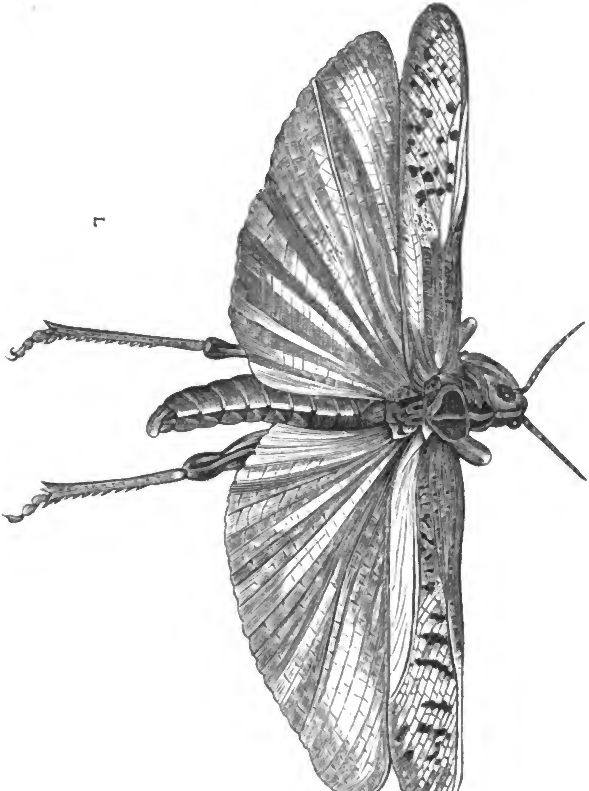
The perfect insect is almost globular, yellowish-red on the upper side, with a brownish-red spot on the thorax. The abdomen is brownish-black, and the legs reddish, or reddish-brown.

Dr. Hammerschmidt has presented the Imperial Agricultural Society with a full description and drawing of this insect in all its stages, from which this account has been extracted. Unfortunately the author says nothing of the means of preventing the devastations of this insect. A good soil and moist weather, which will cause the herbage to grow quickly and luxuriantly, and to be often mown, are, in my opinion, the chief requisites for diminishing the insect, which is found everywhere and every year. By often removing the cut fodder from the field, the insect will be disturbed in its propagation. We therefore see the clover fields most subject to this evil in very dry seasons.

To the above-named insect is added another rather large beetle, the six-spotted leaf beetle, (*Chrysomela sexpunctata*, Fabr.) which, as well as all those of the same family, destined to live on plants, may take an active part in the destruction of herbage intended for fodder. Its natural history is still unknown to me.

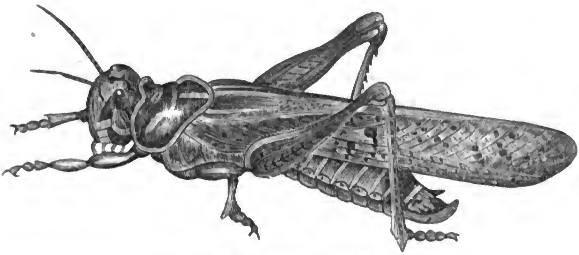
THE MIGRATORY LOCUST. *Gryllus migratorius.* Linn. (*Locusta migratoria*, Leach. *Acrydium migratorium*, Larteille.)

An insect destructive to all vegetation. The locust is fortunately a rare scourge in our country. These insects appear among us every year, but only singly. Their native country is in the plains of Asia, between the Black and Caspian seas, Syria, Palestine, the northern coast of Africa, Egypt, &c., where they sometimes increase to an incredible multitude, and after eating up everything in their native country, favoured by the wind, they perform great journeys



LOCUST WITH ITS WINGS EXPANDED.

in prodigious swarms. Their swarms often measure several hundred fathoms in diameter, and are capable of darkening



LOCUST WITH ITS WINGS UNEXPANDED.

EGGS OF THE LOCUST.

the sun like thick clouds. The noise they make, when busy with the work of destruction, has been compared to the cracking of flames urged on by the wind. When they have alighted in a place, they spare nothing that their sharp teeth can master. Grain of all sorts, meadows, vineyards, and the foliage of trees, are to them equally welcome as food. They stay till they have eaten up everything in the country, and transformed it into a desert; and then they resign themselves to the guidance of the wind, whereever it may take them. Hence it happens that they often pass over large tracts of land, and unexpectedly appear in the middle of another part of the world, as they did in 1827 in the territory of Brandenburg, where they did great damage. Besides the locusts laying waste large tracts of country by their voracity, and causing famine, they become also a real scourge to mankind from the stench which arises from their dead bodies when they are very numerous, and which breeds dangerous diseases. The plague, so frequent in the East, has even been ascribed to the decaying bodies of the numerous swarms of locusts.

This insect is one of the larger species of the genus to which it belongs. Its length from the head to the points of the wings is from two to two and a half inches. Its head and neck are green, its body brownish, the upper wings brown, melting into greenish, and with darker quandrangular spots; the under-wings are transparent, and greenish towards the body. The blue upper jaws (mandibles), which on the inner surface are furnished with sharp teeth, are very characteristic organs, which they apply effectually to devouring the vegetation.

It is very evident that every possible remedy should be applied to get rid of such an enemy as the locust, to ward off from a country a double evil, famine, and dangerous diseases. The best remedy would certainly be one which would prevent the breaking out of those diseases which are occasioned by the stench of the decaying bodies of the locusts; and it has been proposed to endeavour to confine them within certain limits. Means have been tried for effecting this; but further explanation will show, how insufficient, and in many respects how prejudicial, these remedies are. It has been advised, as soon as a swarm of locusts is seen approaching, to drive it back with noise and clamour; and the ringing of bells, firing off of guns and cannon, beating of drums, &c., are recommended for this purpose. Even large heaps of straw are to be lighted, that the fire and flame may compel the enemy to retreat. But it is not always possible to collect the necessary crowd of people on the spot at the time when the flight of this insect takes place, as it cannot be foreseen, and moreover as the locusts sometimes fly so high, that neither the noise nor the fire can have any considerable effect on them. Even if the inhabitants of any district should be so fortunate as to turn the course of an invading swarm, it only flies back soon to return; as it usually has eaten up everything behind it; and if its entrance be prevented in one district, it is only by driving it into another. By this means also a dense mass of locusts, which if it had been confined to a small district, could have easily been destroyed, is frequently divided into smaller swarms, which then infest whole provinces. This renders their destruction difficult; and what is most dangerous, enables them to disperse their eggs through a whole country, and thus to create terror the ensuing year by the young they have produced.

This sort of remedy is, therefore, only to be advised when the locusts can be driven into the sea, a lake, or large river, where they would perish; but we should then be obliged to collect their dead bodies on the shore, and bury or burn them, that their putrefaction might not become injurious to health.

Convinced of the insufficiency and disadvantage of this remedy, orders were given at the last appearance of locusts in Transylvania, in the year 1828, not to disturb them in their flight; but to let them alight in large masses, and only then to employ suitable means for their destruction. The means of destruction must always be modified according as they are applied to the perfect insect, the eggs, or the larvæ. It is unnecessary to mention that single individuals, and even single parishes, are by no means sufficient to put a stop to an evil that spreads around with giant strides, but that the united powers of hundreds and thousands must co-operate in obviating a danger which brings in its train, hunger, misery, and the most exterminating diseases. It is therefore incumbent on the authorities of countries infested by the locusts, to rouse the public spirit of the people, and to give a proper direction to their exertions.

If locusts have settled in a district, a number of people must be collected in proportion to the size of the space of ground they occupy. These people are either to surround the whole ground covered by these insects; or if they are not enough for this purpose, one part of it after another, and kill the locusts with bundles of twigs or brooms, continually narrowing the circle. The dead locusts must then be collected with rakes, or old brooms, and either burnt or buried in deep holes. This labour must be begun if possible immediately after the arrival of these insects, while they are fatigued with their flight; or at night and morning when their wings are wet with dew, and in rainy weather, otherwise they would rise and fly away.

The following method was tried in France in the year 1810. Sheets of coarse linen were sewed two-and-two together, with a bag in the middle, held open by a ring. Two people held the cloth at both ends, and thus about a hundred men formed a barrier, opposite to which nearly as many drove the locusts forwards with brooms and twigs. So long as the insects did not make use of their wings, they hopped forwards and settled in heaps on the linen held before them. They were then shaken into the bags and emptied into holes dug to receive them.

By the following very simple preparation, the destroying of locusts is much facilitated. Bags are to be made of coarse, thin canvas, two feet in length, which are to be stretched on a wire bent into a circle of one foot and a half in diameter, and a long or short handle is to be fastened to the ring. With such a net the locusts on the wing, as well as those sitting on the plants, can be caught, by waving it backwards and forwards, and emptying the locusts into holes. Besides this, ducks, geese, and pigs, are recommended to be driven on those spots where locusts have settled, as they readily eat these insects. This must of course only be done when the place is not cultivated, otherwise the crops in the field would be exposed to a double peril.

When the intruding insects have been destroyed in either of these ways, the eggs that they have laid must be taken into consideration. The locusts do not come to Europe till after they have attained their full growth. Pairing and laying their eggs is now begun. According to difference of age and place, which seems to them more or less suitable, some begin in August, others defer till September to provide for the preservation of their young. Sunny sand-hills, sides of ditches, and places which are sheltered from northern storms by low-wood, are chosen by them for the cradle of their descendants. The mother, provided with two pairs of horny, gimlet-looking appendages, lying over each other, at the end of her abdomen, digs with them a hole, from seven to eight lines deep, in the loose soil, and lays in it from sixty to eighty eggs, each resembling a small grain of rye, of the colour of the yolk of an egg. She fastens them together with a peculiar slime into the form of a longish cylindrical lump, from half an inch to an inch in length, and from three to four lines thick. She smears the whole lump with this slime, which hardens into a brown spongy web, and protects the eggs within it from injury from without. The same autumn, as long as the weather will permit, all possible means must be taken to collect and destroy the eggs of the locusts. Wherever they are suspected to be, the earth must be opened by the plough, where it can be used, and by potato-hoes and other similar implements, to the depth of six or eight lines, where it cannot. The eggs thus collected must be burnt, or buried in deep holes; but in the latter case unslacked lime must be sprinkled over them, or boiling water poured on them, to prevent their developing. This operation must be renewed early in the spring, as in favourable weather the young are hatched as early as March and April. It will not be possible to find all the masses of eggs, as they are difficult to discover from the earth sticking to them, but by breaking up the ground they will be brought to the surface, and exposed to the effects of the weather. Birds and other creatures can then more readily effect their destruction; pigs are particularly recommended to be turned on these fields, as they scent out the eggs and eat them readily.

Should, however, in the following spring, young locusts appear in spite of all these applied means, they must be immediately pursued, as they every day become more voracious and dangerous. They are as small as ants on issuing from the egg; they have feet, but not wings; their colour is at first black, and they feed on young grass and young corn. They change their skin five times before they have attained their winged state, and it is only after the last change, which often takes place in June, that their wings are fully formed, and the insects are fit for travelling.

Before their first change of skin they live concealed in fissures and holes in the earth, on account of their weakness and tenderness, and only come forth in the sunshine. As they are very gregarious, many thousands can be easily killed in a day while they are in this state, by looking for them in their hiding-places and crushing them with the foot, or a broad stick. They are most readily taken in warm weather by drawing the nets, described above, along the grass. This operation may be continued with the best success after the first and second change of skin. At this period, lizards contribute much to their destruction.

The following remedy is advised after they have changed their skin for the third time, and become much larger. Pits are to be dug from two to three feet deep, and the locusts carefully driven towards them with brooms or leafy twigs; while, to prevent them from jumping over, linen cloths are to be stretched on the opposite side. They ought never to be driven against the wind, or on heights. When a considerable quantity is collected in the pits in this manner, they may be covered with earth and stamped down.

The proceeding which I have suggested for the full-grown locust might be of the greatest use at this period; namely, that with linen cloths sewed two-and-two together, with a bag in the middle, &c., as before described.

I cannot avoid mentioning repeatedly, that the dead locusts should either be destroyed by fire or buried in deep holes, that they may not infect the air with their putrefaction; they should also be covered with unslaked lime before burying, for greater security.

THE RYE-GRASS MOTH. *Liparis* (*Bombyx*) *morio*, Autor. *Penthophora morio*, Germar.

A moth injurious to the different species of grass and other meadow-herbage. In the summer of 1836, Counsellor Von Kleyle transmitted to me a moth, together with eggs and caterpillars, which had been sent from the Archduke Charles's territory of Leopoldsdorf, on the west of the

Vienna forest, with the remark, that in the month of May they had done considerable damage to the meadows of that territory, particularly in the village of Hennersdorf. The caterpillars were observed to be most numerous near a brook which ran through the meadows, and in shady places under trees, and in those places the traces of their voracity were most visible.

I recognised in the insect the *Bombyx morio*, which is common every year in the environs of Vienna on meadows and other grassy places, although it has never been so numerous as to attract the attention of the agriculturist from its voracity; and a particularly favourable concatenation of circumstances must have contributed to its increase in that district.

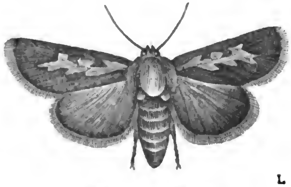
The moth is of a middling size; the male, with extended wings, is nearly an inch broad, and black. The antennæ are strongly pectinated in two rows: and the head, back, and abdomen, are black, the latter with yellow notches posteriorly. The wings are very thin, membranous, transparent, and black, with fringes of the same colour, or sometimes brownish. The female is distinguished by a proportionally thick, long abdomen, which is whitish grey, and woolly at its exterior; and by small, slender, brownish grey wings, which are not adapted for flying.

The caterpillar is found in April and May, living on rye-grass (*lolium perenne*) and many other plants in meadows; its ground colour is velvety black, yellow at the incisions and sides, with a black head and small reddish yellow warts, having ash-grey hairs on them. The cocoon consists of only a few threads; the pupa is yellow, streaked with black lengthways, blackish brown on the wing-covers, and beset with whitish grey tufts of hair.

After pairing, the female lays her eggs at the end of May and beginning of June, round the stems of the grass, and covers them with the down from her abdomen, to secure them from the weather. Two generations appear in long, warm summers; but in general the caterpillar passes the winter at the roots of the grass.

The destruction of this caterpillar when in great abundance is very difficult, as it prefers living in long grass in the day time, or in the ground. Breaking up the meadows in autumn appears to be the best method of destroying the pupæ concealed there; they will thus be exposed to the enemies appointed by nature herself, such as *Ichneumonidæ*, &c., and most effectually be reduced to the number of insects uninjurious to agriculture.

THE ANTLER, OR GRASS MOTH. *Noctua* (*Episema*) *graminis*, Autor. (*Charæas graminis*, Stephens. *Cerapteryx graminis*, Curtis.)



EPISEMA GRAMINIS.

A moth injurious to meadows. The caterpillar of the antler, or grass-moth, has become notorious from the devastations it has repeatedly committed on meadows in various parts of northern Germany, such as the territory of the Hartz, and in Sweden, Norway, &c. * The moth is of a middling size, its head and back are yellowish brown, the collar lighter, almost yellow; the brown antennæ are covered with yellow scales; and the abdomen and the legs are brownish grey, the latter with darker joints. The upper wings are usually brownish grey, with a darker mixture in the middle. The ordinary middle spots are whitish, yellowish, or bluish; the first round, the second half-moon shaped. A strong, narrow line runs from the root lengthwise through the middle of the wings into the half-moon spot, which it intersects in such a manner as to give it the appearance of a three-pronged fork [or horn, whence the common English name of the moth]. The upper border of the wings is lighter; the fringes brownish yellow. The under wings are yellowish grey, nearly black towards the outer border, with yellowish fringes. It flies in the latter end of July and beginning of August.

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* The preceding species does not occur in our country, (at least it is doubtful whether the exceedingly rare *Penth. nigricans*, of Curtis, *Brit. Ent.* v. pl. 213, is identical with it); but the *Charæas graminis* is an inhabitant, and is occasionally as obnoxious here as in Germany. There are some interesting observations upon its habits noticed during its attack on the herbage of Skiddaw, some years ago, published in the *Entomological Magazine*, which, together with some additional observations, are given in the Article "Charæas," in the *Brit. Cyclop. of Natural History*, vol. ii., p. 8.

The caterpillar is brown or blackish, with five lighter stripes along the back; the first and last sections are covered with a hard, smooth scale. The stripes meet at the edge of the anus. The abdomen is blackish. The hind-feet project beyond the anal point. The larvæ are an inch long, and they undergo their transformation about Midsummer, within a light cocoon, under moss, stones, and such like materials, changing into a blackish-brown shining pupa.

The food of the caterpillar consists of all the soft sorts of grasses. It lives at the roots, and eats all the germs. Although it is in existence in autumn, lies benumbed in the earth in winter, and begins to eat again in the spring, yet the effects of its devastations appear chiefly in the beginning of June, when it has changed its skin for the last time. In the years 1816 and 1817, entire hills in the Hartz territory, which were covered in the evening with the finest green, were found dry and bare the next morning, and the ruts in the roads leading to them filled with caterpillars; and sometimes the roads themselves partially covered with them, so that they became slippery and dirty by the caterpillars being crushed. This insect appears only to be injurious in dry situations, particularly in mountain pastures; the caterpillar has never been met with on low, wet, and marshy meadows.

The only means of extirpating or diminishing this caterpillar consists in surrounding the attacked places, as the ground permits, with shallow ditches, or by means of a plough with deep furrows, as broad as possible, and turning pigs into these places to eat the caterpillars. Crows are also among the natural enemies of this insect, and must be encouraged. Continued rains, particularly when they occur about the last time of the caterpillars changing their skin, are sufficient to destroy them entirely, as was the case in the Hartz territory.

III.—INSECTS INJURIOUS TO CULINARY VEGETABLES.

The number of the enemies of culinary vegetables appears much more numerous, when compared with those of the preceding branches of culture, the principal reason of which is that these vegetables are nearer our dwellings, and can be more easily observed than those of field cultivation; and that we have proper opportunities of becoming acquainted with, and tracing the enemy through all the stages of its existence. Besides, the greater variety of vegetables certainly affords suitable nourishment to a greater number of species of insects. Many of the species here described are taken from M. Bouche's *Natural History of injurious and useful Garden Insects*, Berlin, 1833.

THE SPRING BEETLE OR SKIP-JACK. *Elater sputator*, Fabr. *Agriotes sputator*, Esch.

Gardeners remark, often to their great annoyance, that many newly-transplanted lettuces begin suddenly to wither and perish; this happens chiefly in spring and summer. If we seek for the cause, we find in the roots of the withering plants a worm, which is the larva of one of the Elateridæ, which has a great resemblance to the universally known meal-worm.

ELATER SPUTATOR.

This larva eats by degrees the root of the lettuce as far as the collar from which the leaves are developed, and the plant naturally dies. This dangerous enemy to lettuce is light yellow, from six to seven lines long, of the thickness of a pigeon's quill; its body is cylindrical, somewhat flatly compressed at the head, rather pointed behind, tolerably firm, composed of segments, the second, third, and fourth of which have each a pair of short feet; the mandibles are strong, black, and shining. The pupa or nymph is shorter than the larva, paler in colour and something thicker. The beetle, which is developed from the pupa in fourteen days, is from four to five lines long, one and a half lines broad, and has the usual form of the spring beetles; it is slightly curved, the head and thorax are of a dark brown, wing-cases yellowish, striped, the stripes minutely dotted; the antennæ are slender, serrated, and like the feet yellowish-brown; the underside of the body also brownish. It is found plentifully in gardens on various plants, principally at the time of flowering; umbelliferous plants are preferred.

The injury which this insect occasions in its larva state, is often very considerable. My friend M. J. Scheffer, at Mödling, to whom I owe this information, has often lost the fourth part of his lettuces by it.

The surest means of ridding kitchen gardens of these insects, consists in pulling up every plant that begins to wither, and killing the enemy within. If the larva is not concealed in the root, it is no doubt in the earth near the plant, and is easily recognised by its shining yellow colour; and although the lettuces which have been attacked cannot be saved by these means, yet the other plants are secured by collecting the insects, for as soon as one plant is devoured they will attack another*.

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* This species is very closely allied to the *Agriotes lineatus* already described in the second section of this work, its larva being also known under the name of the wire-worm.

THE ASPARAGUS BEETLE. *Lema asparagi*, Fabr. *Crioceris asparagi*, Latr.

Asparagus suffers sometimes through the summer and autumn from the larvæ of two small beetles, which not only strip it of its leaves, but even gnaw the rind of the stem. One of these beetles, from its habitat on the asparagus, is called the asparagus beetle; it is blackish-green; the thorax is red with two black dots; the wing-cases yellow; the suture and three spots united to it on both sides black. It is three lines long.

The larva is spindle-shaped, flat beneath, arched, fleshy, wrinkled, covered with single hairs, bordered at the sides, of an olive colour; the head and legs black. On each side of the abdomen is a row of feet like warts. It is two lines long. The only means of destruction is picking off and killing the beetles and larvæ. The second enemy is

THE TWELVE-SPOTTED LEAF BEETLE. *Lema duodecim-punctata*, Fabr. (*Crioceris* 12-*punctata*, Latreille.)

It is red, the wing-cases lighter, each having six black dots; antennæ, eyes, breast, edge of the abdomen, tips of the thighs and palpi black. It is three lines in length. The larvæ much resemble the former; live also on asparagus, and are to be destroyed in the same way.

THE EARTH-FLEA BEETLES. *Haltica*, Fabr.

The name of earth-flea-beetle is applied to several species of very small beetles, (one of which is vulgarly called the turnip-fly,) which belong to the genus *Haltica* of Fabricius.

A universal and very remarkable characteristic of this family of beetles is the property of making great leaps by means of their very thick hind-legs. All the species are amongst the smallest insects; several are scarcely a line long, the length of the largest is scarcely two lines, and one in breadth. The greater number are shining green, with a brown or yellowish hue. Early in spring they are seen sitting on walls in great numbers; in winter they live under leaves, stems of plants, and in chinks in walls; during summer they are the most dangerous enemies of various vegetables, particularly the cabbage tribe, such as—cabbage, cauliflower, and colewort. They also attack different sorts of the root genus Brassica; such as the turnip, &c. and also the radish, the common cress, and the water-cress. Besides these sorts of vegetables, they also attack flax, tobacco, hops, and sainfoin, but more especially the summer and winter turnips which are left for seed, and often entirely spoil the future harvest during the flowering season, when the weather is warm and dry.

We could scarcely believe that so small a creature was capable of causing perceptible injury to vegetation; but what these beetles want in size, is made up by their numbers and voracity; the extent of the injury is also much increased by the circumstance of their attacking, when young, many vegetables, and not gnawing the young leaves, like most other insects, only on the edge, but eating their surface, piercing them like a sieve, and disturbing the cellular tissue, thus preventing their growth, and finally causing the total destruction of the plant. They love warmth and sunshine, thus are seldom found in shady places; and it is a very just observation that plant-beds bordered by many trees have little to fear from them. Their economy is not yet clearly made out. Some say the larvæ live where the perfect insect does; others that they attack the roots and stems of plants.

No natural enemies are yet known of these destructive insects. Shade, coolness, and rainy weather, are the surest protection of young plants from the attacks of the earth-flea-beetles.

Remedies are not wanting, which have been recommended by various agriculturists and gardeners, against these insects. All these remedies are enumerated and properly explained in an excellent treatise, by M. Wundram, a clergyman at

Dorste, in Hanover, in the *Trans. of the R. I. Agri. Soc. of Vienna*, new Series, Vol. I. Part, 2, p. 103; and those particularly deserve to be recommended, which are proposed by the author; as they have been proved by many years' experience, they are practical both on a large and small scale, they require scarcely any expense, and they take proportionally little time.

These remedies consist in the employment of wormwood and road-dust. Boiling water is to be poured on a handful of fresh or dry wormwood, and suffered to stand from twelve to twenty-four hours, so that it may be perfectly cold, then put the plants that are to be planted out into the decoction with their leaves downwards as far as the stem, so that their roots may not be wet, and then put into a cellar or some other cool place. In six, eight, or ten hours afterwards, they may be planted with the certainty that scarcely an earth-flea-beetle will attack them; if they do touch a leaf here and there which has not been wetted with the infusion, it is of no consequence, as it does not destroy the plant. The bitterness lasts so long that the plant seldom requires to be sprinkled in its new station, unless frequent heavy showers of rain fall soon after planting it out; then it would be a good thing, the next fine day, to sprinkle the leaves with this infusion by means of a wisp of straw. When the plants have grown about a fortnight or three weeks, the leaves will have become too hard for the jaws of the insect, and nothing more is to be feared from it.

Young plant and seed-beds, whether sown with the various sorts of cabbage and turnip-seed, radishes, cresses, or tobacco, &c., will likewise be successfully secured from the earth-flea-beetles by a gentle watering or sprinkling with this infusion of wormwood. Plants may also be rescued from the greedy voracity of these small devastators in a more simple and easy manner by the application of the second remedy, viz. road dust. The dust of chalky stones is to be gathered on the road in a fine day, and stowed up in a dry place for future use. As soon as it is perceived that the earth-flea-beetles appear on seed or plant beds, a night must be chosen when a great deal of dew has fallen; and while the young plants are still wet, they are to be thickly sprinkled with the road-dust, till they look as if covered with powder; whether the dust is injurious to their bodies generally, or only that by covering the leaves it obstructs or is injurious to the action of their organs of manducation is not known, but the earth-flea-beetles all at once disappear from the seed and plant-beds, particularly if the sun shines brightly the following day, and the dust is dried on the plants. If heavy rain falls immediately after the first sprinkling, and washes the dust off the plants, it must be repeated as before.

The application of the infusion of wormwood and the sprinkling with road-dust, are practicable also in field cultivation. The author of this treatise asserts that he has always preserved his flax, and summer and winter corn, as well as white turnip fields, from the *Halticæ*, by these means. Similar effects were observed by the Englishman Arbuthnot, from smoke, which being driven by a current of wind along the field, cleared a large space from these insects. The fire was kept up at a very cheap rate by a little straw, and dry weeds, by which the smoke might be made thicker and more plentiful. Besides these remedies for the earth-flea-beetle, M. Wundram also recommends the following:—let the seed or plant-beds be formed in the middle of a meadow, or grassy place, and we may be sure that they will be free from the earth-flea-beetle, for they do not live in grass, and they cannot come from neighbouring places, because the grass prevents them exercising their leaping powers*.

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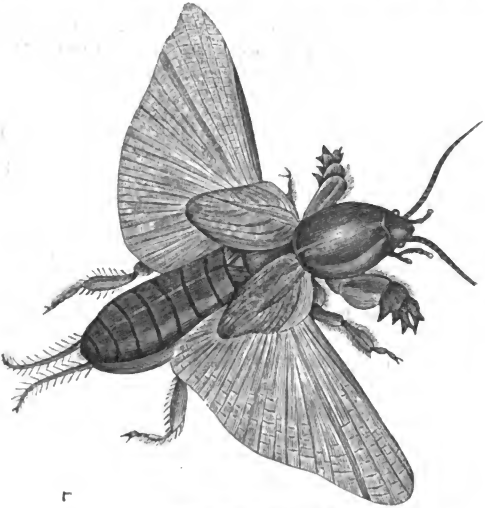
* The recent investigations which have taken place in this country of the habits of the *Haltica nemorum*, one of those insects but too well known to the English farmer under the name of the turnip-fly, have enabled us to clear up many points in the natural history of this tribe of beetles. The Committee appointed by the Agricultural Association of Doncaster, and the proposal of this subject by the Entomological Society of London as one of their prize essays, have led to the publication of a Report by the former body, comprising a vast deal of practical matter; and more especially to the production of a Memoir by M. Le Keux, published in the 2nd vol. of the Transactions of the

The Mole-cricket, Churr-worm, Jarr-worm, E Churr, or Earth-crab. *Gryllotalpa europæa*, R *Gryllus gryllotalpa*, Linn. *Gryllotalpa vulgaris*, Latr.

This insect, which belongs to the family of the crick (Achetidæ) differs essentially in form and habits from



GRYLLOTALPA VULGARIS.

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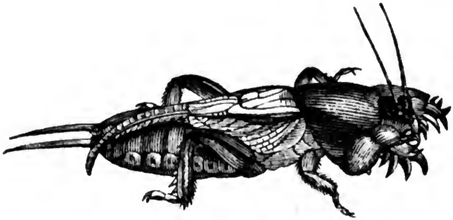
latter Society, in which the complete history of the insect in all stages is at last most satisfactorily traced; and from which it is evid that all the former notions relative to the deposition of the eggs of insect in manure or attached to the seed, are quite erroneous; larva feeding within the full-grown leaf, to which the egg has b fastened by the parent beetle. I have also entered at some length i the habits of this insect in one of the articles of my series of noxi insects.—(Gard. Mag., May 1837.) The chief object of the far will therefore be to accelerate as much as possible the growth of turnip as soon as it apppears above ground, and to drive away insects from the crop until the plants are in the rough leaf, when t are secure from danger.

nigratory locust before described; and is not only one of he most destructive animals to culinary vegetables, but



MOLE CRICKET.

extends its ravages to meadows and corn-fields. This insect lives like the field cricket, (*Acheta campestris*, Fab.) vell known in early spring by its chirping in the earth, does not, like that insect, confine itself to one and the ame hole, but changes its abode according to circumstances; n doing this it does not usually come out at the surface of e earth, but creeps like the mole through passages which it has dug for itself under ground.

Partly from its habits, and partly from the damage it does to various sorts of grain, and finally from its distant resemblance to the crab and mole, this insect has obtained in different parts of Germany numerous opprobrious names. [We have given some of its corresponding English names t the head of this article.]

When fully grown the mole-cricket measures nearly two nches in length, and four lines in breadth. Its colour is ark brown; it has a tolerably small, longish, oval head, which it can retract within the prothorax and protrude at leasure; and two bristle-shaped, rather long and strong ntennæ in front of its black reticulated eyes. Its thorax, which is very like that of a crab, has an elevated thick order, which is covered in its whole extent with the finest woolly hair. The leathery wing-cases, traversed by large and small veins, are attached at the posterior part of the prothorax. The wings which, when expanded, are very broad and almost triangular, afford no idea of their structure when folded up; they are very closely folded, and extend like two ribbons, being separate, and projecting over the abdomen, where they end in points. The abdomen, which consists of nine or ten segments, is rather soft, and at its union with the thorax is rather slender, becoming more expanded in the middle, and it is furnished with two bristle-like filaments almost of the same length as the antennæ, but something thicker at the extremity of the body. The two fore feet are distinguished from the other four by their peculiar form. They are proportionally short, but very broad and strong, resembling the fore feet of the mole; and they are adapted to the same purpose, viz. digging in the earth.

Rösel asserts that the mole-cricket is capable of pushing forward a weight of six pounds with his fore feet on an even surface, by which we may make a calculation of the power with which it can remove the soil in digging its passages.

The female hollows out a place for herself in the earth about half a foot from the surface, in the month of June, and lays her eggs in a heap, which often contains from two to three hundred. They are shining, yellowish brown, and of the size and shape of a grain of millet. This hollow place is of the shape of a bottle gourd, two inches long and an inch deep, smooth within, and having on one side a winding communication with the surface of the earth. The young, which are hatched in July or August, greatly resemble black ants, and feed like the old ones, on the tender roots of grass, corn, and various culinary vegetables. They betray their presence under the earth by the withered yellow patches in the meadows, and by the withering decay of culinary vegetables in the gardens. In October and November they bury themselves deeper in the earth, as a protection from cold, and come again to the surface in the warmer days in March. Their presence is discovered by their throwing up the earth like moles.

As they do a great deal of damage, when very numerous, to the kinds of plants already mentioned; (so much so as, in many seasons, to destroy a sixth, or even a fourth part of the young corn, by digging under and eating off the roots,) it has always been a consideration to find out means of extirpating them. According to the circumstances of season or locality, sometimes one, and sometimes another of the remedies here recommended, will be found more or less applicable.

The surest and most efficacious of these remedies is, without doubt, destroying the brood in June or July. Practised gardeners know from experience, where the nest of a mole-cricket is situated; they dig it out with their spades, and destroy hundreds in the egg state, with little trouble. A much approved remedy which Louis XV. bought of an artist of Lorrain is said to consist of first pouring water into their holes, and then a few drops of any sort of oil. They leave their holes when they feel the water, and when touched by the oil die immediately. It is supposed that their spiracles are stopped up by the oil, and that they are killed by suffocation.

The following is a sure and practicable method of catching these insects: In the month of September, let three or four pits be dug, each from two to three feet deep, and a foot wide, on a flat surface of about six hundred square yards. These pits are to be filled with horse-dung, and covered with earth. After the first frost, all the mole-crickets in the neighbourhood will collect there, to shelter themselves from the cold, where they may be destroyed in heaps. The following mode, though much commended, is not so practical: small pots are to be buried here and there, into which about thirty drops of sulphuretted oil, or oil of turpentine, has been poured; and covered with thin boards that no earth may fall in. The smell of this oil is said not only to drive the mole-crickets from the neighbourhood, but even to kill some of them. Dead crabs laid in their passages, are also said to kill them from their stench. Others advise boiling water to be poured on the bare places in the meadows, to destroy the brood below. But the desired end is attained as speedily, and more certainly, when these places are dug up, and the insects collected and destroyed *.

THE PAINTED FIELD-BUG. (*Cimex ornatus*, Linn.) *Pentatoma ornata.*

Insects of the bug tribes are, in general, predacious insects, and live on others, of which they suck out the juices. The painted field-bug forms an exception to this rule, and becomes a dangerous enemy to the different plants of the cabbage tribe, particularly in dry summers, since in its larva as well as in its perfect state, it pierces the leaves, till it makes them like a sieve.

The perfect insect is from three to four lines long, and from two to three lines broad, and rather flat. Its ground colour is red or white, and it has on the upper side of its body various figures occasioned by the regular dark-green spots there, so that the insect has a very motley appearance. Its head is dark-green, bordered at the sides with red or white before the eyes. The rostrum reaches to between the second pair of feet, and is dark-green, as well as the antennæ.

The thorax is moderately arched, red or white, having, towards the anterior edge, two large dark green spots, with four smaller ones in the middle, in a row. The *scutellum* is large, and triangular, marked with a red or white triangle, the apex of which is much lengthened. On the wing-covers, or upper wings, the dark colour also prevails; they are bordered with red or white, as far as the terminal third part; this border is wavy, both outwardly and inwardly, and is furnished besides with a green spot. The whole of the under side is reddish or whitish; the turned-up edge of the abdomen is marked with dark green spots, and on both sides, a row of similar dots. The legs vary from green to red or white. The larva has nearly the same markings, and is only distinguished from the perfect insect, by its want of wings. The only means of destroying these insects, consists in picking them off, and killing them.

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* It is the opinion of some writers that the mole-cricket does not feed upon the roots of plants, and that if these die, it is owing either to the attacks of some other insects upon which the mole-crickets feed, or to the loosening of the soil about the roots, by the latter. The circumstances related above are evidently the result of practical observation, and, together with the account forwarded to the Entomological Society by the Agricultural Society of Grenada, of the great injury done to the sugar-canes, by the Gryllotalpa didactyla, will doubtless be considered sufficient to set the question at rest.

THE PLANT-LICE. (*Aphis*, Autor.)

The plant-lice are especial enemies to various sorts of culinary vegetables. They, indeed, spare no plant; but they prefer juicy vegetables, and therefore, have been mostly observed on different sorts of the cabbage tribe, peas, and beans. These noxious insects have many natural enemies, which tend to lessen their great increase; namely, the larvæ of several lady-birds, (*Coccinella*,) particularly *Coccinella punctata;* those of bee-like flies, (*Syrphus*); the golden-eyed flies, (*Hemerobius*); and many species of *Ichneumonidæ*. Lye and vapour of tobacco, are recommended as the best means of killing the Aphides, but these remedies cannot well be applied to culinary vegetables.

THE LARGE CABBAGE WHITE BUTTERFLY. *Papilio (pontia) Brassicæ*, Autor.

The wings are white; the upper wings with broad black tips, and the female has two black spots on the middle. The underside of the under wings is light yellow. Breadth when expanded, two inches. It appears from May to October.

The caterpillar is blueish-green, thinly haired, and sprinkled with black dots; having a yellow stripe on the back, and the same on the sides. These caterpillars are found throughout the summer and autumn, on all the sorts of cabbages, horse-radish, radishes, mustard, and similar plants, as well as on water-cresses. The pupæ are yellowish-green with black dots, with a point on the head, and five on the back. The best way to destroy them is picking off and killing the caterpillars, as well as the pupæ, as far as it is possible; the latter are found attached to adjacent trees, hedges, and walls.

But care must be taken not to destroy those pupæ which have a brown appearance; because they are full of the larvæ of Ichneumons, and other allied parasites, which are the great scourge of these caterpillars. If these are destroyed, considerable damage is done. A single pupa contains from forty to sixty larvæ of the parasite (*Diploplepis puparum;—Pteromalus puparum* Swederus). Allowing that the half of the perfect insects produced from them are females, the product of a single pupa would destroy from twenty to thirty caterpillars next year. The yellowish eggs of the butterfly, which are sometimes attached in entire masses to the underside of the leaves, can be easily destroyed; only we must take care not to disturb the dark yellow silk-like eggs, usually found attached to the dead caterpillar; which, in reality, are nothing else but the pupæ of another Ichneumonideous insect (*Microgaster globatus*), which lived in the caterpillar, and caused its destruction.

THE SMALL WHITE BUTTERFLY. *Papilio (pontia) Rapæ*, Autor.

This butterfly resembles the foregoing, but is one-half smaller; and the black tinge at the points of the upper wings is fainter, and not visible on the outer edge. The time of appearance is the same as the former. The caterpillar is of a dull green, with fine white minute hairs, a yellow stripe on the back, and yellow spots on the sides, on a pale ground. In some years, it is very injurious to the cabbage and turnip plants; it also infests the mignonette, which it strips entirely of its leaves. It is very difficult to be discovered from its colour. The pupa is yellowish, or greenish grey, with three yellow stripes. Like the former kind, it is found attached to trees, hedges, &c. The means for its destruction are the same as the foregoing.

THE GREEN-VEINED WHITE BUTTERFLY. *Papilio* (*pontia*) *Napi*, Autor.

The wings are white, with the tips of the upper ones black. The male has one black spot, the female two or three. The veins on the outer edge of the under wings of the female, are black. The under wings are yellow on the under side, with greenish powdered veins. It flies about in April and July, and is of the size of the preceding.

The caterpillar, which lives on the leaves of cabbages, turnips, and mignonette, appears twice in summer, in June and August. It is finely haired, of a faint or brownish green, lighter at the sides, with reddish yellow spiracles, small white warts, and black punctures. It is also difficult to find on account of its colour. The pupa is yellowish-green, with points on the head; and its back is rather lighter than in the foregoing species. For destroying it, the same means are to be followed as with the two preceding species.

THE GAMMA MOTH. *Noctua* (*Plusia*) *gamma*, Autor.

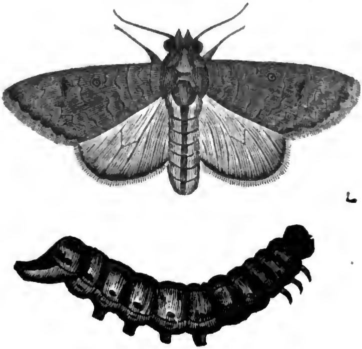
The caterpillar of this beautiful moth is so plentiful in some years, that it does great damage to vegetables, peas, and various sorts of fodder-herbage.

The ground colour of this moth is light, and dark grey mixed with rust colour. The head and collar are of brownish grey, edged with light grey lines, as well as the crested back and shoulders. The abdomen is yellowish grey, with elevated brown tufts of hair. The upper wings are marbled, and have a metallic lustre. The inner edge is wavy, and toothed near the fringes. The notched cross-lines are silvery. Towards the inner border, is situated a silvery or gold-coloured shining mark, which resembles the Greek letter gamma (γ). The under wings are yellowish-brown at the base above the fringes, with black bands. The blackish-brown pupa is inclosed in a white cocoon.

The caterpillar is green, beset with single hairs, having only twelve feet, and a brownish green head. On the back, are four very small yellowish or whitish lines. The feet have a yellow stripe. The spiracles are blackish green. These caterpillars are found from Spring to Autumn in a variety of generations. The only possible means of destroying them, is by shaking them off, and hand-picking.

THE CABBAGE-MOTH. *Noctua* (*Mamestra*) *Brassicæ*, Autor.

The caterpillar of the Cabbage-moth is a great enemy to different sorts of culinary vegetables. The moth is of middling size, one inch and a half broad, when the wings are extended; its head, collar, and back, are blackish-grey, intermixed with whitish and yellowish hairs. The back has a thick double crest. The abdomen is dark ash grey, the upper half beset in the middle with black tufts. The upper wings are


MAMESTRA BRASSICÆ.

grey, with a mixture of yellow and white. The anterior border is very light to beyond the middle, with dark spots; on the watered band are two or three yellowish spots. The cross lines are distinct. The first is rather broad, and the next double the width, with a dark edge, the usual middle spots surrounded with white, the kidney-shaped one in the middle, with a whitish-grey lunule, surrounded with a blackish colour; the usual conical spot is dark, and surrounded with brown. The watered band is extremely light, and terminates at the white notched line, marked with a W. At the first bend of the above line, is a softened-off rusty spot. Near the border of the grey, yellowish-striped, and toothed fringes, is a row of small, black, triangular marks. The under wings are light grey, with dark veins, and central spots; blackish towards the outer edge. The moth appears in May and June, sits in the day-time on hedges, the stems of trees, or on the earth, and only flies at night.

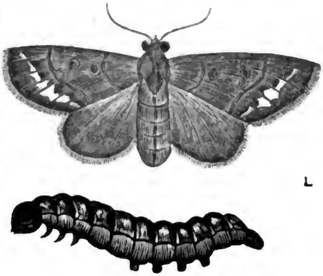
The caterpillar is green, more or less covered with grey or black. It has a dark stripe on the back, on which there is a pale indistinct line. Above, it is sometimes furnished with dark or pale spots placed lengthwise. At the sides is a dirty yellow stripe, which becomes reddish above. Close above this spot are two white spiracles, surrounded with black, each in a small black spot.

When this caterpillar appears in great numbers, it does considerable damage to several vegetables; such as cabbages, lettuces, &c., by eating out the heart. It appears in July, August, and September. To look for them and kill them is a troublesome, although the only sure way of getting rid of them.

THE WHITE LINE BROWN-EYED MOTH. *Noctua (Mamestra) oleracea*, Autor.

The caterpillar of this moth sometimes does a great deal of damage to different sorts of culinary plants, in the same manner as the moth last described.

The moth is dark rusty-brown. The antennæ have white scales. The abdomen is ash-gray, with brown tufts. The feet are grayish-brown, yellow ringed below. The fore wings have no connected cross lines. The round middle spot is surrounded with white. The kidney-spot is orange-colour in the shape of a lunule. Very delicate white and black dots are seen on the watered band. The fringes are deeply toothed, bordered by a faint white line. The under wings are ochre yellow, or dirty white, with darker shades towards the whitish fringes.



MAMESTRA OLERACEA.

The reddish or yellowish brown caterpillar, has on the back, and on each side a dark stripe, and a whitish one nearly over the feet. The under side and feet are light brown; it is dotted with black between the dark stripes. When young, and sometimes also when fully grown, the ground colour is green. The pupa is shining reddish brown, and remains in the earth during winter.

The food of the caterpillar consists of all sorts of cabbage, lettuce, &c.; it sometimes does considerable injury to the former; and can only be destroyed by hand-picking.

THE CABBAGE-GARDEN PEBBLE MOTH. *Botys* (*Pyralis*) *forficalis*, Autor. (*Mesographe f.* Hubn, Step. *Scopula f*, Curtis.)

Of the family *Pyralidæ*, a small group of moths, this species only deserves to be mentioned, as its caterpillar sometimes greatly injures several different sorts of vegetables.

The head, back, and upper wings of the moth, are hazel brown, and brownish gold; the antennæ light brown; the abdomen and under wings whitish. On the upper wings are two distinct, and two faint deep rusty brown stripes. The underwings have a brownish-yellow curved line, towards the outer edge. Breadth one inch. The first brood flies in May, and the second in August.

The caterpillar is found in May and June, and the second generation in September and October. It has a light brown head, and a yellowish green body, with blackish stripes running lengthwise, and blackish dots, having fine white lines between, and white incisions and spiracles. Its length is about eight lines. When these caterpillars are numerous, they do important damage to the cabbage tribe and horseradish. There is scarcely any other means of destroying them, than to shake them off, and bury them immediately, which is not easily accomplished in large fields.

THE CARROT MOTH. *Tinea* (*Hæmilis*) *daucella*, Autor.

The caterpillar of this very small moth is a great enemy of carrots.

The moth has palpi bent upwards, strongly brush-shaped, and brownish-gray. Head and back reddish-brown, with single black atoms. Abdomen and feet ash-gray, the former with white incisions. The upper wings are of a reddish-brown colour. There are many black streaks following the direction of the veins, which are particularly apparent between the outer and posterior edge; some white atoms are scattered over and between them. Fringes, of the same colour, surround an indistinct row of dots. The under wings are ash-gray, lightest nearest the base; their fringes yellowish. On the underside, the upper wings are dark, the under wings light gray.

The caterpillar lives on carrots, and eats the flower and seeds, for which purpose it closes the flower umbel over it with a web, and does a great deal of mischief, some years destroying the whole crop of seed. It is greenish-gray, inclining to yellow, strewed with black tubercles emitting hairs. Indistinct streaks run lengthwise on the back. The head and upper side of the thorax are brown. It attains the length of half an inch. The means of its destruction are simply hand-picking, which is troublesome from the small size of the insect. M. Bouché, however, recommends parsnips to be planted at the distance of eight or ten feet among the carrots. As the insect prefers this plant to the carrot, the parent moth will choose it to deposit her eggs. These isolated parsnips will be entirely consumed by the caterpillars, while the carrots will be spared; and at the time of the ripening of the seeds, the parsnip and the insects within it can be destroyed.

ROESEL'S TINEA. *Tinea* (*Œcophora*) *Roesella*, Autor. *Glyphypteryx Roesella*, Stephens, Curtis.

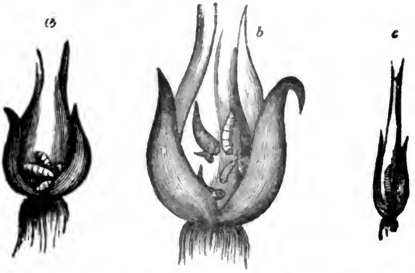
This moth, the little caterpillars of which sometimes do very sensible injury to our choicest vegetables, is among the smallest, and at the same time, the most beautiful insects of Germany.

The head, back, abdomen, and feet of this moth, are blackish-brown, with something of metallic lustre. The antennæ are black and annulated with white. The upper wings are reddish-yellow, blackish round the edges, on which are nine silvery spots, as Linnæus calls them; but more correctly, a silvery cross line formed of two spots run into one, above the middle of the wings; the other spots single, three being on the anterior edge, two on the posterior edge, and two small ones on the shoulders, and in the middle of the space. They are all surrounded with black. The fringes are blackish brown, and dull. The under wings, with their long fringes and the whole of the underside, are simply blackish-brown. The breadth of the insect with the wings extended, is five lines.

The little caterpillar is yellowish green. The head and two spots on the first segment, are shining blackish-brown. Close to these spots are a few dots of the same colour, on each side. It lives on common spinach, and on the strawberry blite, (*Blitum capitatum*). In some years it is so plentiful in May, till the middle of June, that it eats the plants bare. Three or four of these caterpillars live together on a leaf, under a thin white web. At the time of transformation, they leave the plants they fed on, and betake themselves to the rents and fissures in trees and walls, where they make a slight cocoon, and become pupæ. The moth appears in ten or twelve days. Apparently three generations are produced in summer, when the weather is favourable. In April, the moth is very abundant on the Forget-me-not, sweet Alyssum, &c. It is seen in smaller numbers in the end of June, in July, and finally in September. Besides spinach, the caterpillar also eats the strawberry blite, and *Chenopodium bonus Henricus*. The only, but very troublesome means of destroying these grubs, is to look for, and kill them.

The Onion Fly. *Anthomyia Ceparum*, Meig.

The larva or maggot of a small fly, which is only half the size of a house-fly, does considerable damage to the various sorts of onions.



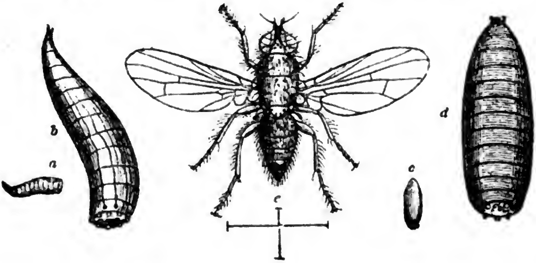
ONIONS ATTACKED BY THE LARVÆ OF ANTHOMYIA CEPARUM.

The perfect insect or fly is entirely of an ash-grey colour in the female, or with black stripes on the back of the male;

the wings clear like glass, with broad iridescent reflections, and yellowish brown veins. It is found throughout the summer in several generations. The larva lives during that season singly, and also gregariously on the different sorts of leeks and onions, and does great damage among the white onions, (*Allium Cepa*), so that it often destroys the whole crop.

It is conical, smooth and shining, fleshy, bare, white; the incisions finely granulated; the spiracles on the fore part of the breast having small, yellow, furrowed, oval scales. The last joint of the body is obliquely truncated, and the truncated surface is surrounded by eight small fleshy points. The round, flat, brown spiracular plates, have each three longish spiracles, in the form of a triangle; and under them, four small fleshy points are to be observed. The length is two or three lines.

Grub or larva *a*; magnified *b*; puparium, within which is the real pupa, *c*; magnified *d*; perfect insect magnified *e*; the cross lines showing the natural size.



The fly lays her eggs on the leaves of the onion, close to the earth. The newly-hatched maggot bores through the first leaf, and then descends between the leaves into the onion to its base, when it entirely destroys the bulb, which soon becomes rotten. It leaves the onion to undergo its transformation in the earth, and becomes an elliptical, reddish-brown wrinkled pupa, out of which the perfect fly is developed in Summer, in from ten to twenty days. The later brood pass the winter in the pupa state.

It is very difficult to destroy these insects. Almost all the means hitherto proposed, such as strewing ashes, &c., have failed. Strewing the beds with pounded charcoal has been found the most useful; but it must not be applied to every part of the beds, because it is considered advisable to sacrifice a portion of the crop, rather than lose the whole, by leaving patches free from charcoal, where the parent fly will deposit her eggs, and when hatched, the larvæ can easily be removed in the onion left for them to devour, and be buried very deep or burnt. It is particularly desirable to remove all the infested onions early out of the beds, before the flies are developed; and these onions are easily known by their outward leaves turning yellow *.

THE CABBAGE FLY. (*Anthomyia Brassicæ*, Bouché.)

Another small fly, hardly half the size of the common house-fly, is a great enemy to various sorts of cabbage. The perfect insect is ash-gray; the thorax has three indistinct black streaks on the back. The wings are clear like glass; the abdomen is linear, with black stripes on the back in the male, or entirely ash-gray in the female; the length is three lines. The insect is seen through the whole summer.

The larva very much resembles that of the onion fly (*Anthomyia ceparum*), but is thicker. The incisions are smooth; the anal joint truncated; with the truncated surface surrounded by ten fleshy points; the four lower of which are in pairs. The spiracular plates are reddish brown. It lives throughout the summer in several generations under ground, in the roots and stems of plants of the cabbage tribe, in which it eats passages, and causes them to rot.

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* This insect forms the fourth article in my series of insects most injurious to cultivators, published in the Gardener's Magazine for June, 1837, No. 87. My specimens, however, underwent their transformations within the rotten roots and stems of the onions, instead of creeping out into the earth, as described above, which is an important point in their economy with the view to their destruction.

It often destroys whole fields of cabbages, without a remedy being as yet discovered, that is effectual and practicable for destroying it. Dipping the plants to be transplanted in oil or lye of ashes, or soaking the holes that are to receive them with these liquids, will often destroy the plants, and cannot therefore be recommended. Avoiding the use of new dung is also of no avail, as these root-devouring larvæ are not annoyed by the want of it; nor are they conveyed in it into the field, as many suppose.

The only way of diminishing this destructive fly is to pull up, and carry away betimes, the plants attacked by the larvæ, which may be easily discovered by their dull lead colour, and the withering of their leaves in the sunshine.

THE LETTUCE FLY. (*Anthomyia Lactucarum*, Bouché)

This fly is rather smaller than the former; it is blackish brown; the under part and sides of the segments of the abdomen varying gray. In the male the wings are brown, and with broad stripes of iridescence. The female is entirely dark gray, and has pale wings. Length two lines and a half. It flies in July.

The larva greatly resembles the former, only that it is smaller and smoother, and its colour varies more into yellow. It destroys the seed of the lettuce, and other salad plants, so that in many seasons there is but a very poor crop of seed. It is almost impossible to destroy these insects.

THE NEGRO FLY. (*Psila Rosæ*, Meig.)

The carrot is also often exposed to the attacks of the larva of a small fly. This insect in its perfect state is slightly haired, shining black, rather of a metallic green. The head is reddish-yellow, antennæ and palpi with black tips. Legs light yellow; balancers white; and wings clear like glass. It is two lines long. It is found throughout summer. The larva lives in the carrot, where it eats ages; it is found particularly near the extremity of the n root. The carrots die off by degrees, as they cannot v sufficient nourishment from the fibrous roots. When ots have been attacked by this insect, they lose their et taste, and become what the German gardeners call y; from the rusty colour assumed by the passages of the gots.

he larva of the carrot-fly is cylindrical, pointed ante- ly, like parchment, shining, smooth, bare, pale yellow; anal joint is rounded, having posteriorly above two k, rather elevated spiracular plates, the latter having a t point at the end. Leaving the carrot, the larva is sformed in the earth into a small light brown, obliquely ressed, little oval mass; the short, roundish head end which is obliquely truncated, and rather hollowed out re. At the anal end, the two spiracular plates of the .a form two small tail points.

he only way to diminish their numbers, is to pull up sickly infested carrots, which are distinguishable by r yellow outer leaves, and early withering; and to roy the insects contained in them, before they change pupæ.

SECTION III.

INSECTS WHICH INJURE THE VINE, GREENHOUSE AND HOTHOUSE PLANTS, ORCHARDS AND WOODS.

I.—INSECTS WHICH INJURE THE VINE.

THE number of insects injurious to vines is fortunately not great, and even those few do not appear every year, like most of the other insects injurious to fruit trees; nor are they prevalent in many districts at the same time, so that a general failure in this branch of rural economy, in consequence of their ravages, is never to be apprehended. Vines in gardens generally suffer most, because they, as well as the insects that cause the damage, are more secured from the effects of the weather *.

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* From the valuable Memoir lately published,by the Baron Walckenaer, in the " Annales de la Société Entomologique de France," and translated in the " Entomological Magazine," upon the insects injurious to the vine; it appears that this number is much greater than M. Kollar seems to have believed. The most injurious species is, however, the *Pyrale de la Vigne*, or the *Cochylis Vitisana* subsequently described, and of which the habits have been studied with great minuteness, by Messrs. Audouin and Guérin, during the past autumn (1837). The accounts which these authors have given of their observations, have appeared in several of the French periodical works, and a summary of the experiments of M. Audouin has been translated and published by Mr. Loudon, in the Gardener's Magazine, No. 92, Nov., 1837. In addition to the insects mentioned in the text, and in the memoirs above referred to, the *Otiorhyncus sulcatus*, one of the weevils, whose history I have detailed in the Gardener's Magazine for April, 1837, has also been observed to be occasionally very injurious to vines, by gnawing off the young shoots, although it ordinarily devours the roots of more tender plants, such as succulents, &c.

The Vine moth, *Tortrix* (*Cochylis*) *vitisana*, and the Coccus of the vine, are the greatest pests of the vines so situated.

Rhynchites (*Curculio*) *Betuleti*, Schönh.

Rhynchites Bacchus, Sch., has hitherto erroneously been considered as the peculiar enemy of the vine; it is, however, never found on vines, but only on other kinds of fruit trees, and is essentially distinguished from the *Rh. Betuleti*, by its shining copper-colour.

The latter insect is a small weevil of a metallic green, or steel-blue colour. It is four lines long, including the rostrum; the latter being nearly a third of the whole length; it is tolerably broad, and turned downwards. On the thorax of the male towards the front on both sides are observed short spines; the abdomen is almost quadrangular. The spines are wanting on the thorax of the female, and her rostrum is shorter. The beetle appears in spring, as soon as the trees are in full foliage, and begins its work of destruction in May. It makes use of the leaf of the vine partly for a dwelling, and partly for the food of its young.

When the female has selected a suitable leaf, she cuts the petiole with her rostrum almost half through, so that it hangs down; and is more conveniently placed for future proceedings. She then begins to roll the leaf together, generally alone, but sometimes assisted by the male. While this operation is going forward, she also lays her eggs; that is, she pierces the roll, lays an egg in the opening, and pushes it in with her rostrum, in such a manner that it remains on the inner surface of the leaf. When she has introduced five or six eggs in this manner, between the different folds, she rolls the remaining part of the leaf entirely together, so that it is impossible to discover, from the outward appearance, in what manner the eggs were deposited.

This beetle finds the pear tree also suitable for its purpose, rolling up the leaves of the leaf-buds. It generally chooses the leaves of those buds which contain many leaves, so that I have found rolls consisting of from twelve to fourteen leaves. I also observed that it had bitten through the top of a young shoot, so as to make it fall on one side, then seizing the leaves of this shoot one after another, formed them into a roll, and deposited its eggs as before described.

In a few days the eggs are hatched in the rolls, and a whitish small worm comes out of each egg, with black oblique stripes over the back, and a reddish head. Its food consists of the leaf itself, of which the roll is formed. When the worm is hatched, the roll is already dried; it must, therefore, be satisfied with the dry leaf, which, however, is generally more or less moistened by rain. As only a few eggs are contained in the roll, and as they are laid in different folds, each maggot finds nourishment sufficient to enable it to attain its full size. In four or five weeks it is fully grown. In the mean time, the petiole and the roll have become so dry, that they are easily torn off by a moderately high wind, and fall to the earth. If this does not take place till the worm is fully grown, it leaves the partly consumed roll, buries itself in the earth, and appears again in spring as a weevil.

This beetle is therefore the real weevil of the vine, which sometimes does great destruction in vineyards, by defoliating the vine; when this is the case the grapes will not ripen, and the vintage becomes abortive. But the possessors of vineyards need not suffer the mischief to become thus extensive, if they would take the destruction of this insect seriously into consideration. As they know the period of its appearance, and retreat, why should they suffer it to lodge unmolested in the vineyard? As it is tolerably large it cannot be overlooked, and may consequently be easily destroyed, particularly as it allows itself to be taken without flying away. Vine-growers pay very great attention in other respects to their vineyards, and expend much labour upon them; but to what purpose is this labour, if they suffer themselves to be deprived of their fruit by a beetle? They could secure their vineyards still more effectually from the attacks of this insect if they were carefully to collect and destroy the rolled up leaves which contain its young; and they would have plenty of time for this operation, as the rolls do not fall off for a week or two, and it is generally longer than that before the worms arrive at maturity.

Should this beetle become numerous in orchards, it ought to be attended to immediately, as it might do great injury by rolling up the leaves of the young trees; particularly as it applies the leaves of the young shoots to this purpose. Let them therefore be taken away, as many as can be caught, and the leaf-rolls pulled off, and burnt or crushed, to diminish their number for the future.—[Schmidberger.]

The Vine Beetle. *Lethrus cephalotes*, Fabr.

A beetle, which has some similarity to the very common dorr or dung-beetle, *Scarabæus* (*Geotrupes*) *stercorarius*, Linn., is reckoned among the number of insects that injure the vine, particularly in the southern parts of Hungary, where it is very frequently met with.

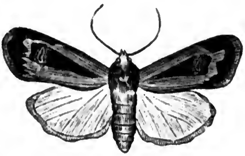
It issues from the earth in spring when the vine has begun to shoot, creeps upon the branches, bites off the leaf and flower-buds with its very strong jaws, and carries them back to the opening through which it left the earth, apparently as provision for its young.

The only way to protect the vine from so dangerous an enemy is to collect and kill the beetle, which can the more easily be accomplished, as the insect is striking from its form and size, and carries on its evil practices in open day.

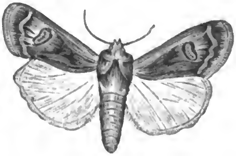
The largest male specimens are from eight to ten lines long, and six lines broad, black, and shining. The head is very large, and the upper jaws of the male have a long tooth turned downwards. The thorax is very broad, much broader than the abdomen, and gives the insect an appearance of great strength. The abdomen is short, moderately arched; the legs rather strong, the fore-legs adapted for digging.

Noctua (*Agrotis*) *aquilina*, Autor. (*Noctua domestica*, Fabr. iii. 6. 23.)

In the beginning of the month of June, 1833, M. le Chevalier von Stettner, proprietor of the territory of Thürnthal on the Wagram, and corresponding member of the committee of the Imperial and Royal Agricultural Society of Vienna, pointed out a hitherto unobserved enemy of the cultivator of the vine. He sent some of these caterpillars which had done great damage to the vines in his neighbourhood, to the committee of this society, requesting a particular definition of the insect, and a specification of means for destroying it. The society sent the caterpillars to me, and I knew at the first glance that they were the larvæ of a moth, of the family of the Noctuidæ, *Phalæna noctua*, Linn., and of the genus *Agrotis*, Treitsch; but it was not till the latter end of July, when I obtained some moths from the caterpillars which had entered the pupa state, that I could decide upon the exact species.



FEMALE.



MALE.

AGROTIS AQUILINA.

To make myself better acquainted with the habits of this insect, which I had not before studied, and to discover the means proper for its diminution or extirpation, I went in company with M. Ernest Heeger, a member of the society, and a very experienced entomologist, to Thürnthal, and requested M. von Stettner to conduct us to the place where the caterpillars were found.

M. von Stettner was kind enough to take us to a vineyard his neighbourhood behind the village of Fels, where we were soon sufficiently convinced of the devastation occasioned by these caterpillars; as almost all the leaves of the vineyard showed signs of their voracity, and a great number of the vines were entirely stripped, not only the grapes, but the young shoots also, being injured. We did not see a single caterpillar on the vines themselves, but as we searched in the ground, we found round every vine several which had penetrated some inches into the earth, or their pupæ, while no other insect was to be found; so that no doubt could remain that the destruction was caused by them. The vineyard was situated between some corn-fields, and a fallow field, already ploughed. We searched this last field, and found in the loose soil a number of these caterpillars and pupæ; a proof that the insect does not live on the vine alone, but on other plants also; and apparently it had only attacked the vine for want of other food. The other vineyards that were injured were situated precisely as this one.

As the moth proceeding from this caterpillar is never rare in Austria, and yet as the oldest inhabitants of this district do not remember for upwards of fifty years that it was ever observed on the vine, it is obvious that this insect is not one of the peculiar enemies of that plant, but only has recourse to it occasionally for want of other food.

A particularly favourable concatenation of circumstances must have contributed to the extraordinary increase of this species this year; for in the neighbourhood of Vienna, I have observed hundreds of these insects every evening throughout the month of July fluttering about flowering shrubs, particularly the *Clematis vitalba;* and yet the vines in this district have not suffered in the least from the caterpillars, there being, in all probability, a sufficient supply of other plants to nourish them.

Although this insect has hitherto seldom been observed, it is yet of sufficient importance to require means to be devised for setting bounds to its devastations in case it should again appear to any extent.

The moth of this caterpillar appears, like all other insects, under four different forms at different periods of its existence, viz. as an egg, as a worm-like larva, or caterpillar, as an immovable mummy-like pupa, and lastly, as a perfect insect, or moth. It feeds upon leaves only in the caterpillar, or larva state, when it is injurious to various plants; in the moth state it only sucks the honey of the flowers, and has then no other destination but that of laying its eggs for a future progeny.

The perfect insect, or moth, appears in the month of July, flies about only at night, and seeks its food in flowers abounding in honey. Pairing also takes place at this time, on the ground under the leaves of plants, where the more unwieldy female reposes. The female then lays her numerous eggs in the earth, and in situations where the young caterpillars, on leaving the egg, may find suitable nourishment.

It would undoubtedly be most advantageous to proceed to the fields in search of the perfect insect; because, in this way, by destroying the parents their pernicious progeny would be killed in the germ. But on considering the habits of this moth, we shall see how difficult, or even impossible, it is to put this design into execution.

The moth sits in the day-time quietly on the ground, or on the leaves of the plants; it is small, being nearly eight lines long, and four lines broad; its colour is earthy brown, so that it can scarcely be distinguished from the ground it sits on. It does not begin to fly till after sunset, and then will be found settled on the flowers of the plant. But what trouble the catching of this moth would be to the inexperienced butterfly-hunter! and after all it would chiefly be the males that were destroyed, for the females seldom fly, even at night. Fires of straw lighted in the fields would be equally unavailing, as the males only would fly to them and be burnt. From this it is evident that nothing effectual can be accomplished with the perfect insect, and that their diminution or destruction must be left to the bats alone, which ought on this account to be spared, and not extirpated.

It is as difficult to destroy the eggs as the perfect insect. They are very small, and are concealed in the earth. At the end of August and in September the young caterpillars appear, remaining in the earth in the day-time, and gnawing off the tender leaves of different plants only in the night; they prefer for their nourishment the different sorts of ladies'-bedstraw, (Galium). They will do no injury to the vine at this time, its foliage being hard and firm. At the approach of cold weather they cease eating, and go deeper into the earth, where they pass the winter in small cavities two or three inches under the surface. At this season also, when the caterpillars are so small and lie concealed, but little can be effected towards their destruction. Birds, particularly the different sorts of crows, which devour not only the larvæ of the cockchaffer, but all other earth-caterpillars, do most execution at this time. We should therefore endeavour in every possible way to entice these birds to the fields, instead of driving them away with fire-arms. Field-mice contribute greatly in diminishing the different sorts of insects that live in the earth, but moles still more so, as their food consists solely of worms and insects. It is therefore no advantage to fields and meadows when moles are persecuted and killed.

In the beginning of spring this caterpillar leaves its winter quarters, and seeks out the same plants that had served it as food the preceding autumn. In default of these plants it proceeds further, and strays to the vineyard, where the tender leaves and fresh shoots of the vines seem to furnish it an agreeable and nourishing food.

This is the period when most can be effected towards destroying these insects, if they attack vines, or other valuable crops. They have now attained a considerable size, and are therefore more easily found. But alas! no traps can be laid for them as for noxious quadrupeds and birds, no poison can be strewed, as for mice and rats; in short there is no way of destroying them but by gathering them with the hand. If any traces of a caterpillar's voracity are observed on the vine, nothing remains but to examine the plants n the evening, or even at night with lanterns, and collect and destroy the caterpillars. They leave the vine in the daytime, and either lie on the ground, or in the earth itself. As the vines are generally hoed up about this time, the caterpillars that are turned up in the course of this operation, may be found without much trouble. When fully grown the caterpillar is from one to one and a half inch long, and of the thickness of a large quill. Its form is cylindrical, almost of equal thickness throughout; its body smooth, shining, of a dirty grey colour, with light and dark streaks on the back, placed longitudinally. It has sixteen feet, six on the breast, which are the true feet, and ten ventral feet, which are more like minute warts, and serve to give the insect a firm hold on the leaf or stem. It is fully grown at the end of May, or beginning of June, when it ceases eating, and suddenly disappears, so that an inexperienced person knows not where it is gone, as no trace of it is to be found in the earth. It changes its form at this time, making for itself an egg-shaped cocoon of earth, and it is therein transformed into a light brown pupa. It now again easily escapes observation, as it lies constantly in the earth, and is also inclosed in its own case. In this state it passes three or four weeks, takes no food, and is finally transformed into the moth already described.

This concise account of the habits of the insect will be sufficient to enable cultivators to choose the most suitable means for its destruction at the proper season, in case of its recurrence; and may at the same time be useful in removing the superstitions of the country people, who always find a cause for wonder in every unusual appearance in nature.

In the following year 1834, this same caterpillar appeared in many vineyards in Weikersdorf, and Meissau. The proprietors lost no time in going with lanterns into the vineyards at night, where they collected the insects in large pots, and destroyed them, and thus saved their vines. These creatures have also been observed in Bohemia, on the territories of Prince Schwarzenberg.

THE VINE TORTRIX, *Tortrix* (*Cochylis*) *vitisana*, Jacquin. *Cochylis reliquana*, Treitsch.

Vines which are trained on houses, or in gardens on walls and trellises, frequently suffer greatly, near Vienna, from the caterpillar of a small moth, the *Tortrix vitisana*, first described and figured by Baron Nicol Joseph Von Jacquin, in his *Collectanea*. Vineyards in the open country are less exposed to this pest: it was only in the years 1816, 1817, 1828 and 1835, that traces of them were seen here and there.

If the vines in gardens are examined in April and May, this moth will be seen sitting on the branches; it is most readily observed if the branch is beaten with a stick, when the insect flies out, and soon settles on it again. The female at that season lays her eggs singly on the twigs or buds of the vine, from which the young are hatched at the time when the blossom-buds are unfolded. These caterpillars fasten several blossom-buds together by means of whitish threads, and eat off the inner parts of the blossoms. When they have finished one part of the bunch of blossoms, they proceed to another part, and do the same till the whole bunch is as if covered by a spider's web. The longer the blossom-buds remain small, the greater number of them will be required for the food of the caterpillar; therefore the devastations of this insect will be most felt in cold wet springs. Instances have occurred of trellises, though rich in blossom, not having produced a single ripe bunch of grapes, all having fallen a prey to these caterpillars.

When fully grown, the little caterpillar measures three or four lines, is dirty green, and beset with whitish minute warts, from which arise stiff hairs; the head and first segment of the body are yellowish brown, the six fore-feet blackish, and the others the same colour as the body. They enter the pupa state towards the end of June, and appear as moths twelve days afterwards. Pupation takes place either in the cocoon, or in a curled up leaf. The pupa is brown with rough points.

The moth is three or four lines long, and with the wings extended, six lines broad. The head is yellowish brown; the antennæ, which are half as long as the whole insect, are black and annulated. The upper wings appear marbled with rust-colour and blueish grey, having two incomplete cross bands of the latter colour, or whitish, in the middle of the first of which, towards the centre, is a dark rusty dot. The second band has several dots and streaks of the same colour, placed irregularly; and a confused whitish mark which springs from four pair of little hooks, on the anterior edge; the space between the innermost pair is very dark. The under-wings are white, with brownish veins and snow-white fringes.

The caterpillars of the second generation of this moth appear towards the end of August, and beginning of September, from the eggs of the first. These are also found on the bunches of grapes, but they do less damage, as the berries are then of considerable size. The caterpillar penetrates into them, and feeds on their unripe pulp. When a berry is so much consumed that it begins to wither, its caterpillar spins a round, hollow passage, which forms a bridge for its passage into another grape. Four or five grapes are sufficient, in general, for the nourishment of one caterpillar; but in rainy weather the mischief extends to a greater number, because those the caterpillars have begun to devour soon rot, and the infection spreads to those near. The fully grown caterpillar then leaves the bunch of grapes, to undergo pupation either at the root of the vine, or in some other suitable place. The pupæ of the second generation remain in this state throughout the winter, and it is not till April of the next year that the moths are developed from them.

This Vine Moth is not the only species of the family *Tortricidæ* which selects the vine for its food, and in many years destroys the hope of a rich vintage, particularly on espalier vines; in Germany, as well as in France, other species of *Tortrix* have been observed, which have a great resemblance to the one just described, in their manner of life.

Next in order to the *Tortrix vitisana* in this respect is the *Tortrix roserana*, Fröhl., which greatly injured the vines in Wirtemberg, and of which M. Von Roser, Councillor of Legation, has given a very circumstantial account in the *Transactions of the Wirtemberg Agricultural Society*, Dec. 1829.

This insect having repeatedly done great damage to the vines on the island of Reichenau, in the lake of Constance, the local authorities of the Grand Duchy of Baden felt themselves under the necessity of making the natural history of this insect, together with the means of its destruction public, through Professor Nenning of Constance. The means of diminishing and destroying these insects, so nearly allied in their habits, can only be applied in their larva and pupa states, and consists in the immediate searching for, and killing the insects themselves.

For this purpose the blossom-bunches must be examined in spring, and if they are covered with any thin web made by the caterpillars residing within, they must be destroyed. We must take the precaution of holding the hand under the bunch during the search, otherwise the small caterpillar might fall to the ground (as is the habit of the larvæ of the *Tortricidæ* when alarmed). The bunch must not only be freed from the caterpillar, but also from the web which envelopes it. If the caterpillars have already entered the pupa state, they must be crushed or pricked with a pin.

The old bark must be peeled off the vine in autumn, because the pupæ lie concealed under it and in the fissures of the branches. What is thus peeled off must be collected by having a cloth spread under the vines, and immediately burnt.

It is only by these means that the superabundant increase of this moth can be checked with certainty. The experienced cultivator will be the best judge whether the cost expended on this operation does not, in many cases, exceed the profit of the vine, and whether it is not more advisable to leave the destruction of the insect to its natural enemies.

The Scale Insects. *Coccus*, Linn.

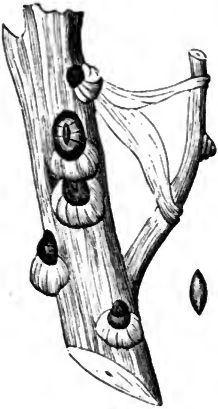
The family *Coccidæ*, or scale-insects (to which the cochineal insect, *coccus cacti*, so highly prized as a material for dyeing, also belongs), contains many species, which live as parasites on various plants, particularly on hothouse plants, and do them considerable injury. They are very singular insects, passing the greater part of their life on one and the same spot, and rather resemble an excrescence than a living creature. They belong to the order *Hemiptera*, Linn. in which the bugs, plant-lice and *Cicadæ*, are included; although the main characteristic of the order corresponds only with the males, as they only are winged. The females are shaped like a scale or shield, convex above, flat or concave below, provided with six very delicate feet, which sometimes, chiefly when the female has grown old, merge into the substance of the body. Anteriorly, at about the third part of the length of the insect, is situated a short or long rostrum on the under-side, which it inserts into the epidermis of plants, and sucks out their juices. After pairing, when the eggs begin to develop themselves, the female dies, and her body serves as a protection and shield to her posterity, by covering the eggs till the young are hatched, when they crawl away. While young both sexes are alike, afterwards the winged specimens are developed from the male larvæ and acquire two wings and usually two long tail threads; they are thus very distinct from the female, which looks like a larva during her whole life. There is also a great dissimilarity in point of size, as the male in all the species is scarcely to be distinguished with the naked eye, while the female sometimes attains the size of a grain of linseed, and even that of a pea.

On plants which grow near Vienna in the open air, the scale-insects only show their baneful effects in warm weather; in hothouses, on the contrary, they are found throughout the whole year, and they are a great pest to the gardener, as almost all sorts of plants of whatever species are attacked.

The scale-insects are much more difficult to destroy than the aphides, as they do not die from the effects of tobacco; and the other proposed means, such as soft soap, vinegar, &c., when applied in large quantities tend in an equal degree to destroy the plants. The best remedy is to brush off the insects from the twigs and stems, and to wipe them off with a cloth or sponge from the leaves of the more tender plants. It is a fortunate circumstance, that in most of the species, the old specimens which have been removed can never return to the plants, as their feet are injured. It is advisable, however, to cleanse plants in pots at a distance from the greenhouse, as the young insects and even the old ones of some species, creep up again and renew their depredations. The trees mostly infested with the scale, are :—the peach, the plum and damson, the wild chestnut and the vine.

THE VINE SCALE INSECT. *Coccus vitis*, Schr.

This insect forms a longish, marbled brown scale. In old age the scale becomes blackish brown, hemispherical,



COCCUS VITIS.

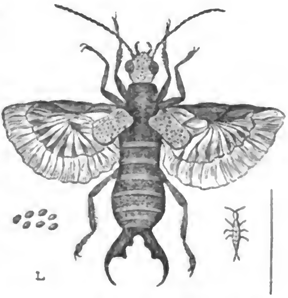
and wrinkled. The eggs, which are laid under the body of the female, are covered with long white wool. They are found on vines, particularly in gardens. Their destruction is best effected by dry-brushing in autumn or in spring.

II.—INSECTS WHICH PARTICULARLY INJURE GREENHOUSE AND HOTHOUSE PLANTS.

Some of the insects which will be described in this place do not confine themselves alone to hothouse and greenhouse plants, but equally attack other plants; notwithstanding this, I have thought it better to introduce them here on account of the surpassing injury they do to this branch of cultivation.

THE EARWIG. *Forficula auricularia*, Linn.

This well known insect, considered, without cause, as very dangerous to mankind, must find a place among those chiefly injurious to fruit and flowers. Its size varies according to its age and sex. When fully grown it measures eight or ten lines, including the forcep-like appendage at the end of the abdomen; its breadth is two lines. The body is light-brown, free from hair; it has very short wing-cases, under which the wings lie concealed folded both longitudinally and transversely. Its usual habitats are under the bark of trees, in the hollow stems of trees, in rolled up leaves, and under stones. In orchards it particularly injures the fruit of trees which are trained as espaliers, such as peaches and apricots, which



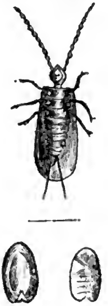
FORFICULA AURICULARIA MAGNIFIED, EGGS AND YOUNG.

are often entirely pierced through in warm weather. Earwigs also attack the other sorts of fruits, particularly pears and apples. In flower-gardens they destroy carnations, pinks, and dahlias in particular.

The only certain method of destroying earwigs is by catching them; which is best effected by hollow tubes, which are to be laid here and there in orchards and flower-beds. The common reed is fit for this purpose, but the hollow stem of the sunflower is even more so, as the insects are eager in the pursuit of the remains of the sweet pith. They are also easily caught between the folds of paper, or in pieces of cloth and linen laid on the ground. They creep into these traps in the morning after their nocturnal rambles, and may easily be shaken out and killed at any time of the day*. Some amateurs of pinks and carnations, place the feet of their flower-stands in vessels of water, which prevents the earwigs from creeping, but not from flying, upon the plants.

THE ORANGE SCALE INSECT. *Coccus hesperidum*, Linn.

It appears like an elliptical nut-brown shield, and is very plentiful on greenhouse plants, particularly on orange trees,



COCCUS HESPERIDUM, MALE AND FEMALES MAGNIFIED.

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* See *Gardener's Magazine*, vol. xv. p. 190, for a newly invented trap for this insect.

where it fastens itself on the branches and leaves, particularly when the trees are kept rather warm. It is best destroyed by washing the branches and leaves. If this is done in autumn when none of the insects are very young, it is a great advantage, as the old ones cannot creep up again.

THE PINE-APPLE SCALE INSECT. *Coccus Bromeliæ*, Bouché.

It appears like a gray, elliptical, rather elevated shield mottled with brown, and is very like the one just described. It lives on the pine-apple, the justicia, hibiscus, &c. This parasite propagates throughout the whole year, and great caution must be used in destroying it, as the young ones when brushed off, will ascend the plants again, and take possession of their old abodes. The best way of clearing the pine-apple is to scrape the insects off with the thumb from the leaves, which generally crushes them, and which causes less injury to the leaves of the pine-apple than to those of most other plants.

THE MEALY BUG. *Coccus Adonidum*, Linn.

This species differs from the preceding one in not being shield-shaped, it resembles the woodlouse, is reddish, and strewed with white dust. At the sides of the twelve segments of the body it is provided with small tubercles. The male is slender, and gnatlike, with two rather broad wings, and two long brush-shaped tail filaments.

This foreign species has, alas! become a native of hothouses, to the great annoyance of plants and gardeners. It attacks a number of species of plants, particularly the soft-leaved dicotyledonous kinds, such as the coffee-tree, *Justicia*, *Ruellia*, *Cestrum*, *&c.*, it is also found plentifully on *Musa*, *Canna*, *Renealmia*, *&c.* The only way of diminishing the number of these insects, is to brush them off carefully with soft brushes; but care must be taken not to crush them on the plants, as their juice greatly injures the leaves.

Brushing them off, must either take place at a distance from the hothouse, or they must be killed immediately, otherwise they will creep up on the plants again, as their feet are effective even when they are old.

ASPIDIOTUS, Bouché.

This is a genus related to the scale insects, which is only distinguished from them by the real insect lying under a shield formed of secreted juices. The males have also two wings, and under them two balancers. Their habits are the same as those of the scale-insect. The best known species are:

THE OLEANDER SCALE INSECT. *Aspidiotus Nerii*, Bouché.

The female appears as a yellowish, round, flat shield, almost destitute of limbs, which sucks plants with its rostrum. The shield of the male larva is smaller than that of the female, and quite white. The perfect male is brownish yellow, dusted with white, and white wings. Length, one third of a line. It lives in amazing numbers on different kinds of plants, both of the stove and greenhouse, particularly on oleanders, acacias, aloes, palms, &c., and can only be destroyed by careful brushings. All sorts of ointments and infusions hitherto tried, have had no effect. Its native country is said to be America.

THE ROSE-SCALE. *Aspidiotus Rosæ*, Bouché.

The female is like that of the former. The male pupa is linear, doubly furrowed on the back. The perfect male pale red, dusted with white, and white wings. Length, one third of a line.

They live on the stems and old twigs of rose-trees, which are often entirely covered with them, and look mouldy. The best way of getting rid of them, is brushing them off with strong brushes before the rose-trees sprout. Rose-trees are very much injured by these insects, and will die if they are not destroyed.

THE CACTUS-SCALE. *Aspidiotus Echinocacti*, Bouché.

The female bears a great resemblance to the oleander-scale, only that the muscle-shaped shield is more oblong and darker. The male is orange-yellow, the pupa linear, doubly furrowed, powdery, gray. Its native country is said to be Mexico. It lives in Europe on the different species of Cactus, particularly the Echinocactus.

THE SWEET-BAY-SCALE. *Aspidiotus Lauri*, Bouché.

The shield of the female is oval-shaped, brown, with a remarkable reddish-yellow elevation before. The male is pale cherry-red; the body flat; the antennæ rather shorter than the body. The shield of the larva the same as the female, but narrower. Length of the shield, half a line. This insect lives chiefly on the twigs and leaves of the Sweet Bay, and weakens it if not removed in time. But it is difficult to remove, as it is so firmly seated that brushing is not always sufficient; a pointed stick must therefore be had recourse to.

THE ROSE-MOTH. *Tinea* (*Ornix*) *rhodophagella*, Kollar.

In early spring, as soon as the rose-tree begins to bud, a very dangerous enemy to the growth of its leaves and blossoms arrives. It is the more to be dreaded as, from its smallness and peculiarity of form, it is easily overlooked by the gardener or amateur. If the new leafshoots are closely examined, a little brownish scale is found here and there attached to them; and upon nearer inspection, we shall be convinced that it is a little case, in which a worm, the larva of a small moth, is concealed, which gnaws the tender shoots. When it has devoured one shoot, it removes with its house, and attacks another; and thus, in a short time, one of these larvæ can strip a whole branch of its shoots. The larva which lives in the little case, is only a few lines long; yellow, with a black head, and black spotted collar. It undergoes pupation in its case, which enlarges from time to time, as necessity requires. The moth appears at the end of May. It is only three lines long, carries its wings very close to its body, almost wrapped round it. The whole body is silvery shining gray; the upper wings strewed with minute black dots, deeply fringed at the posterior edge; the under wings are narrow, pointed, with very long fringes. According to Mr. Heeger's observations, to whom we are indebted for this communication, the moth lays her eggs in May on the buds of the rose-trees, and the caterpillars are hatched at the end of June; they immediately form for themselves small cases of parts of the leaves, and pass the winter in them at the root of the rose-tree.

The only certain way of preserving rose-trees from this enemy, is to look for these small cases in early spring, before any foliage is developed, when an experienced eye, which has been accustomed to observe insects, will easily discover them. They must, however, be crushed immediately, and not thrown on the ground, as, if they are, they will re-ascend the rose-tree.

THE PLANT-MITE (OR RED SPIDER). *Acarius telarius*, Linn.

A small insect of the class of *Arachnida*, (Spiders, &c.) scarcely visible to the naked eye, does considerable injury to various plants in warm dry summers. This mite has eight legs, like most of the Arachnidæ; its colour changes from yellowish to brown and reddish, and, on each side of the back, is a blackish spot. In the open air it usually attacks kidney-beans. Among trees, the young limes principally suffer, and the mites are found in thousands on the under side of the leaves. These leaves assume a dirty yellow or brownish appearance, and in the middle of summer the trees acquire an autumnal hue. In the Linden Walk, on the glacis at Vienna, several of the trees suffer every year from this evil. In winter the insect is found on the bark. In hothouses, the red spider feeds during the whole year, and is a great pest to planters and gardeners. It spins a sort of web over the leaves, particularly on the under surface, and sucks the juice of the plants with its rostrum, which completely enfeebles and defoliates them.

Frequently sprinkling the plants with cold water has been found efficient as a means of destroying these insects. Also repeatedly fumigating the hothouses with strong tobacco-smoke, injures them in some degree. They are most abundant when the plants are kept too warm in summer; and as most hothouse plants thrive well when placed in the open air in July and August, placing them out will almost entirely free them from these insects. When hothouse plants are placed in the open air, the precaution must be taken of sinking the pots in a warm dung or tan-bed, to keep the roots warm. The roots being preserved in this way, the plants will defy the coldest weather they are ever likely to be exposed to in summer. For kidney-beans that are trained on sticks in the open air, it is necessary in autumn and winter to cleanse the sticks from all loose rind, as the mites take up their winter quarters within it, in whole families, and if they are not destroyed, proceed from it to the young plants the ensuing spring.

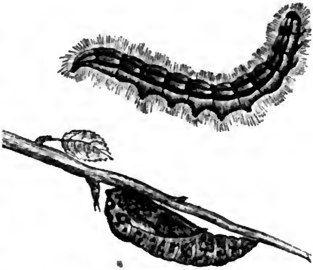
In planting lime-trees, care should be taken that the soil is perfectly suitable for them, that they may not get sickly, and attract this insect. I have observed that all the limes in one and the same avenue, have not suffered in the same degree; and that the large-leaved lime, *Tilia grandifolia*, which apparently requires a better soil, appears almost always to be infested with the mite, while on the smaller-leaved limes, no traces of them are perceptible. Perhaps also the soft, tender leaf of this lime is more attractive to the insect.

III.—INSECTS INJURIOUS TO FRUIT-TREES.

The number of insects which live on fruit-trees, and which do greater or less injury to the orchard, according as they are destined to live on the foliage, blossom, fruit, or wood of the tree, is considerably greater than those we have described in the following division; but as the natural history of many of these insects is not yet sufficiently known, we have preferred giving only the most important and best known of them. Besides, if gardeners and pomologists were made aware of the enormous host of enemies they have to combat, they might be discouraged in pursuing this delightful branch of horticulture. The greater part of the biography of injurious insects here introduced, we owe to our esteemed member Mr. Joseph Schmidberger, canon regular of the convent of St. Florian.

THE BLACK-VEINED WHITE BUTTERFLY, OR HAWTHORN PONTIA. *Papilio Crategi*, Linn. (*Pieris Cratægi*, Stephens, Curtis.)

The black-veined white hawthorn butterfly, *Pieris Cratægi*, is a lepidopterous insect which only flies by day, seeks its necessary food, and fulfils the work of propagation. It is of a considerable size, and quite white, except that the ribs or veins of the wings, and a short oblique stripe from the second to the third vein of the upper wings, are black. This distinguishes it from the cabbage butterfly, *Pontia Brassicæ*, so destructive to kitchen-gardens, which is also for the most part white, and almost of the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PIERIS CRATÆGI.

same size, having a broadish black border at the tips of the upper wings. Besides this, the under side of the posterior wings of the cabbage-butterfly are yellow, and its fore wings have always two black dots on the under side, which are seldom seen on the upper one. I am thus particular in pointing out the difference between the hawthorn and the cabbage-butterfly, because it appears to me that these equally destructive butterflies are sometimes confounded with each other; which is of some importance as regards their destruction, as the caterpillar of the first only attacks trees, that of the latter, the various plants of the cabbage tribe.

In the year 1829, I did not see this butterfly till after the middle of June; but in 1830, it appeared at the end of May. In 1829, in which year I closely observed this insect, I found its first eggs on the 3rd of July; they are shining yellow, cylindrical, rather thinner at the ends than in the middle, and longitudinally ribbed. They lie exposed upon the leaf without being covered with any sort of wool, sometimes in an upright position, sometimes lying in rows one against another, to the number of one hundred and fifty: at least I counted that number on a leaf on which a female had laid her eggs. On the 16th of July the eggs became of a silvery colour, looked more deeply ribbed, and as if covered with beads at both ends. The little worm could already be perceived shining through some of the eggs, as they were near hatching. On the 18th, some of the caterpillars appeared, and next day all had left their cases; which as soon as they were empty, melted like wax in the heat of the sun. In order to have the caterpillars in my room when they were hatched, and also to be able to observe them afterwards, I laid a leaf covered with these eggs, on the leaf of a tree in a pot, and fastened it on with a pin; but although they attained the whitish colour, they all died; a proof I think that even the eggs draw nourishment in some way from the leaf, for otherwise they must have hatched, as they were so near their development *.

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* I fear the worthy canon of St. Florian has arrived at this conclusion, on too slender premises. The eggs might be deprived of a certain degree of moisture sufficient to cause the development of the

The newly hatched caterpillars are dirty yellow, and covered with hair, the head is black, and there is a black ring round the neck, and a brownish-red stripe on both sides. As soon as it began to rain, they immediately drew the leaf together over them by means of a web; and on the 21st of July a covering was ready, under which they were quite sheltered during continued rain. In the meanwhile they enjoyed the food which the epidermis of the leaf afforded; and they gnawed it entirely off, so that nothing remained but the veins. In six days they were obliged to look about for another leaf, they accordingly added the next leaf on the same shoot, to their abode, connecting it with a web. After this task was accomplished, they removed to the new leaf, to feed upon that. About this time they underwent their first change of skin, on which occasion they varied but little in point of colour. They always returned in the evening to their nest, which was formed of the leaf drawn together and covered with a web, as they arranged it when they first came out of the egg. They fastened the leaf immediately to the shoot with threads, that it might not fall off. When it rained, or when the sun was very hot, they retired to their nest, which was so well contrived that not a drop of rain could penetrate it. As the caterpillars increased in size they required more nourishment. They in general consumed a leaf in less than two days after their first change. On the 31st of July, they had already deprived the fifth leaf of its epidermis. The leaves of a single shoot, however, when it is strong, generally furnish them with sufficient food throughout the summer, till their retreat into winter quarters; particularly as, during the whole period, their numbers are gradually diminishing. Birds and insects destroy them, and many perish from unfavourable weather. Rarely twenty or thirty out of a family, sometimes much fewer survive to occupy their winter habitation, which they begin to prepare early in autumn; usually in September, when

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caterpillars, by being brought into his study, which they would obtain in their native situation, without their drawing any nourishment from the leaf; a fact which has never yet been asserted by insect physiologists.

they cease eating. They generally bend one leaf over another, or bring the edges close together, and unite them with threads, covering the chamber thus formed within, with a fine web, so as only to leave themselves a small space to enter at. They also unite the petiole of the leaf which they have prepared for their nest, with the shoot by many threads, so that neither wind nor rain may detach it*. After this operation, they all return to the nest, and secure it on all sides from wet and cold. As the family by this time is not very numerous, each caterpillar selects a place in the chamber, and makes a web for itself, in which it reposes securely throughout the winter; uninjured even by very severe weather.

The first warm sunshine in spring, which causes the sap to flow, entices the caterpillars of the hawthorn butterfly to leave their nest. At first only one or two come out; which seem as if they were sent to ascertain whether there were a sufficient supply of food for them all, as they return to their dwelling without tasting any. At the beginning of April, 1830, the blossom-buds on trees in the open air, had already begun to shoot, when the caterpillars left their nest by degrees, attacked the blossom-buds and consumed them. On the dwarf-tree which I had taken into my room in the middle of March, for the purpose of observing these insects in the nest attached to it, they came out in the end of March, and began to feed on the blossom-buds.

As their old abode was in a decayed state, and otherwise uninhabitable from impurity, they made a new and enlarged one, into which they retired every evening, or when unfavourable weather set in. When they had eaten up the blossom-buds, they attacked the leaf-buds which were already unfolded. They grow very rapidly when they have sufficient food, particularly after their second change of skin, which in the open air, took place in most of them on the 12th of April. Those which had from the first selected the leaf-buds as their food, exceeded in growth those which lived on the blossom-buds. The caterpillars acquired after their second change, two rows of yellow spots down the back, close to, and between which extends a black line. The back is covered with yellow and white hairs, and from the black stripes on the sides, oblique ash-gray stripes extend parallel to each other to the under side of the body.

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* I have related an analogous proceeding, undertaken by the caterpillars of an East Indian Thecla, in the first part of the 2nd volume of the *Transactions of the Entomological Society,* adding several additional particulars of a similar nature, of other Lepidopterous species, having for their object either the fastening of the leaf to the twig, to secure a winter retreat, or a place in which the pupa state may be securely passed.

In the middle of April the third moulting took place in some individuals. The caterpillars had now a black stripe in the middle of the back, which extended to the posterior part of the body; to the right and left were the yellow hairy stripes, close to which another black stripe reached from the head to the extremity of the body. The yellow dots, to which the yellow hairs were attached, were not so perceptible as after the second moulting; and the white hairs were more thinly scattered. They are easily distinguished from the caterpillars of the yellow-tailed moth, as the larvæ of the latter have always two reddish-yellow tubercles, on the last segment but one.

After the third moulting, the caterpillars separated and dispersed in the garden. As early as the 23rd of April, I saw two caterpillars preparing for pupation. Each passed a strong thread round its body near the middle, which it fastened on both sides to the stem, or branch; it also spun a web at the end of the body, which it fastened to the stem in the same way. They both became immoveable by the 26th of April; on the 27th, the anterior part of their bodies moved so violently, that I was afraid it would be detached. After this motion had ceased, the back of the first segment became visible, and one part of the body appeared after another till, in a short time, the pupa was completely disclosed. It is whitish yellow, beset with black dots and stripes. It remains in this state till the end of May, or beginning of June, when the butterfly appears and propagates its species.

With respect to the destruction of this noxious insect, the Creator has provided against its too great increase, by making it the food of other insects, and of several birds. Field-bugs (*Cimicidæ*) watch the caterpillars when they leave their nest, pierce them with their rostrums, or beaks, and suck their juices. Ichneumon flies insinuate their eggs into the bodies of the caterpillars when fully grown, or into the pupæ, which serve the future parasitic larva for food. I also found a fly depositing its whitish-yellow eggs upon them as they began to stiffen and prepare for pupation, thus providing a feast for its future progeny. Small birds, particularly the titmice, devour them soon after they are hatched, as well as in the following spring when they are dispersed upon the shoots. So eager are the birds in the pursuit of these caterpillars, that they break into their nests late in the autumn, to obtain them.

It has already been observed that but few of these caterpillars survive till the time of retiring into winter quarters, and as they are exposed at the period of pupation, and even during its continuance, to the attacks of various enemies, it may be supposed that they very rarely increase to such a degree as to injure fruit-trees so seriously as the Green-looper Caterpillars *, and those of the Yellow-tailed Moth. I have never, since I began to study the insects injurious to fruit-trees, seen the hawthorn caterpillars in such numbers as entirely to defoliate a fruit tree, which frequently happens with the green-loopers, and yellow-tailed moth caterpillars; and though some pomologists make great complaints in their writings, of the devastations which the caterpillar of the hawthorn butterfly has committed in orchards, I think it possible that they may have confounded the caterpillars of the hawthorn butterfly with those of the yellow-tailed moth, as they resemble each other so as to be only distinguished on close inspection; and as both species defoliate the shoots in the same manner throughout the summer, both retire to a nest in autumn, and in spring recommence their attacks in the same way, and almost at the same time, on the blossom-buds and leaves.

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* Of the *Cheimatobia brumata,* Stephens; *Geometra brumata* Linn., or the winter moth.

Notwithstanding this, as it must be confessed that the hawthorn butterflies are in some years, (from the destruction of their natural enemies the birds, or other insects), more numerous than at others, and that these years they do considerable damage to the orchards, it may be as well to state the measures usually taken for lessening the evil. The best way of destroying these caterpillars on low fruit-trees, is by seeking out the eggs or young caterpillars, on the branches, and destroying them. The hawthorn butterfly prefers the apple tree to deposit her eggs on, and selects the lower trees in preference to the higher ones. If we closely examine these trees in June, we cannot overlook either the eggs or the caterpillars, as the former lie exposed on the leaf and are very conspicuous from their shining yellow colour, while the caterpillars are betrayed by their web, and the adjacent gnawed leaves.

As the hawthorn butterfly also lays her eggs on tall fruit trees, particularly if there are no low ones in the orchard; and when this is the case we can neither see the eggs nor the young larvæ, on account of their distance from the eye, the mode of destruction must be delayed till the autumn; that is till the leaves have fallen off, when the nests of the caterpillars will become visible. As it is usual to clear the trees late in the autumn from the nests of the caterpillars of the yellow-tailed moth, the opportunity should be taken at the same time to destroy those of the hawthorn butterfly. The nests of these two species of caterpillars are easily distinguished from each other; those of the yellow-tailed moth being of considerable size, and consisting of several leaves, as will be subsequently shown in describing that insect; while the nests of the hawthorn butterfly consist, as has been observed, usually of but one leaf, and hang down from the shoot, so that they swing backwards and forwards in the wind. Frequently two or three leaves of the fruit-buds are seen curled up but not united, and suspended only by the threads with which the caterpillars have fastened the petioles to the shoot; those leaves must also be removed, as the caterpillars of the hawthorn butterfly are frequently found in them also.

As these caterpillars, as we have shown, leave their nests early in spring; the gathering of them, if delayed till this season, must take place in March, or even earlier, if the weather permits. Every nest that may have fallen on the ground, must be carefully picked up and conveyed out of the garden, otherwise the caterpillars would find their way back to the trees, and thus render the labour completely ineffectual.

As the caterpillars of the hawthorn butterfly, when they leave their nest in spring to feed, still remain close together; and only disperse, as we have said above, after the third moulting; they may be easily found and destroyed at that season, if their nests should have escaped observation when the trees were cleared of the nests. Lastly, a person provided with a butterfly-net can take the insect on the blossoms of plants and shrubs on which it delights to sit in the month of June, and to suck the honey. When every means that have been here recommended for destroying the hawthorn butterfly have been applied, these troublesome guests will not be able to increase so much as to injure our fruit trees. [Schmidberger.]

The Yellow-tailed Moth. *Bombyx* (*Liparis*) *chrysorrhœa*. *Porthesea chrysorrhœa*, Stephens *.

The Yellow-tailed moth, *Bombyx chrysorrhœa*, may justly be reckoned among the most destructive insects of the orchard, the larvæ of this moth often infesting fruit trees to such a degree, that not a leaf or fruit remains uninjured, as was the case in the year 1828. The yellow-tailed moth, is a nocturnal lepidopterous insect; as it only flies about, and propagates its species at night. In the day-time it sits quietly on a leaf, or on a wall, and suffers itself to be caught in the hand. It has received its name from the posterior part of its body being covered with a round mass of golden yellow hair. Its fore wings are of a dazzling whiteness, as is also the greater part of its body, only the principal vein of the fore wing of the male is brown on the under side, and it has also sometimes a few black dots on its wings. The male is distinguished from the female by its more slender abdomen, terminating almost in a point; by a smaller tuft of hair on the tail; and by its strongly pectinated antennæ, the rays of which are yellowish brown.

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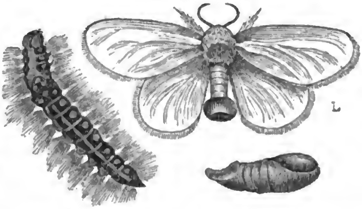
* It is very rarely that this insect, in our country at least, is sufficiently abundant to cause any injury to the fruit trees; indeed they more frequently feed upon the white and black thorn. Linnæus, however, calls them the pest of gardens; and Pallas relates in his Travels, as cited by Mr. Curtis, that he saw this moth flying in such vast abundance in the environs of Winofka, that he took it at first for flakes of snow. It appears in this country somewhat periodically, being found sometimes very abundantly in the New Forest, and at Coombe



BOMBYX CHRYSORRHŒA, WITH ITS CATERPILLAR AND CHRYSALIS.

At the end of June, this moth usually appears, seeks a companion, and continues its species. In the beginning of July, the moths are numerous both on high and low trees if the weather has been favourable, and if the caterpillar had been plentiful in spring. The female usually lays her

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Wood, in Surrey; although I have never seen it in the latter place, during many years' collecting. In France, there appear two broods; one in the spring, and another in the autumn. The periodical appearance of this and many other insects may be perhaps attributed to the failure in the preceding year of other species, whose duty it is to check the superabundance of these noxious insects. The cultivator should, however, take advantage of their appearance in the winged state, as the destruction of one butterfly would prevent the deposition of a certain number of eggs, and the mischief attendant thereon.

eggs on the under side of the leaf, in a small heap or mass, and covers them with hair from her tail. Hence, nothing is seen of the eggs as they lie in rows under the covering of hair. The number of eggs in a heap, amounts to from two to three hundred; they are round, and of a gold colour. When the female has laid her eggs, she dies; after having applied all the hair from her tail to form the covering.

The caterpillars are usually hatched at the end of July. They have a dirty yellow appearance, a black head, and a black ring round the neck; they are thickly covered with hair, and have four rows of blackish dots along the back. Of these dots two pairs on the anterior part of the back, and two pairs on the posterior part, are larger than the rest. By these dots the young caterpillars of the yellow-tailed moth, are strikingly distinguished from those of the hawthorn butterfly.

The caterpillars of the yellow-tailed moth feed, like those of the hawthorn butterfly, on the epidermis of the leaf, which they gnaw off, making a web over themselves. As the leaf is generally somewhat curled up, they draw threads from one side to another, so that there is a clear space in the middle at the midrib, where they all assemble and feed on the leaf as long as it lasts. They lie in security under their web, because it is so thick and well closed, that neither rain, nor wind, nor even hostile insects, can penetrate into it.

After a few days, nothing but the skeleton of the leaf is left, and the caterpillars remove to the next leaf, and again make themselves a web to feed under at their ease. To prevent the leaf on which they are encamped from falling off, they fasten the petiole to the shoot with several threads. When still young, they begin to make a regular dwelling; that is, a caterpillar's nest. For this purpose, they attach by threads a second, and sometimes a third leaf to the one they are feeding on; and form either one or more chambers. They line them with a web, and surround them externally with many threads. The whole nest is either firmly united to the shoot, or, the footstalks of the leaves composing the nest are fastened with so many threads to the shoot, that it can only be torn off by force.

This nest is never entirely forsaken by them; some are always seen creeping in, others within, and others creeping out, whatever may be the state of the weather. From this nest, the caterpillars proceed to the place of feeding; retreating to it for refuge, when very cold winds or heavy showers come on; though a little cold or rain does not frighten them. In this manner, one leaf after another of the shoot is robbed by degrees of its epidermis, and only the brown burnt-looking skeleton remains. They change their skins in August; in the middle of September they cease feeding; and in October they only come out of their nest in very fine warm warm days, when they lie on the outside, but return into the nest in the evening; they become benumbed in November. They pass the winter in their nest, and endure a great degree of cold; none of them being killed by the frost on the 2nd of February, 1830, which was twenty degrees *Reaumur* (sixty degrees below zero *Fahrenheit*). On the outside of the nest exposed to the weather, they will endure from five to six degrees of frost; and even in èxtreme cold they only become benumbed, and resume their activity when warm weather sets in.

Before the buds on the trees have begun to burst in spring, some of the caterpillars come out of their nests, and eat the unfolded leaves. In the course of a few days, they are found in multitudes at the forks of the branches, on the side of the tree exposed to the sun. If cold or rainy weather sets in, part of the caterpillars make a new web for protection, but part remain near their old nest, and return to it; for some caterpillars are always found within the old nest, and others not far from it. At the end of April, they change their skins for the second time, still keeping close together in two or more heaps. About the latter end of May, they change for the third time; they are then reddish-brown, marked on both sides with white spots, as far as the extremity of the body, which is thickly set with hair along the back, and has two spherical reddish-yellow tubercles on the back of the penultimate and ante-penultimate abdominal segments, which the caterpillar can elevate or depress at pleasure. After this moulting, which they undergo either in the old nest, under the new web, or in the open air, they disperse over the different fruit-trees in the garden.

Pupation takes place in June; several again unite, roll some leaves together into a ball, make for themselves jointly a brownish web, and become dark brown pupæ. They prefer the damson-trees for pupation, to which they repair from the neighbouring apple and pear trees, and undergo their change to the number of from four to twelve in a ball. At the end of June the moths, as we have said, begin to renew their species.

Few kinds of caterpillars are less delicate in the choice of food than those of this moth. They feed on beech and oak leaves, as well as on those of pear, apple, and plum trees *, and for this reason the female moth lays her eggs on the tree that happens to be nearest. When the caterpillars have undergone their second moulting, they are no longer satisfied with the outer skin of the leaf, but consume it entirely, always excepting the leaf-stalk, and the middle or chief nerve of the leaf, of which they only consume a small portion of the end, and leave the other part uninjured. From this circumstance we know at a distance whether the larvæ of the winter moth, or of the yellow-tailed moth, have defoliated the trees, for those of the winter moth not only eat the leaf, but the whole of the footstalk, so that on the whole tree there is nothing green to be seen.

With respect to the destruction of this highly noxious insect, various means exist in nature for keeping their excessive increase within bounds. The egg of the yellow-tailed moth has a powerful enemy always at hand, in a very small Hymenopterous fly, scarcely visible to the naked eye. This fly lays its eggs singly in the eggs of the yellow-tailed moth, so that instead of a caterpillar a fly is produced, which makes use of the egg for its food, and the shell for its dwelling. As these flies are often very numerous, a great number

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* Stephens gives white and black thorn, elm, oak, fruit trees, &c., as the food of this species.

of the eggs of the moth perish by their means. Throughout the spring and summer other insects destroy the small caterpillars, particularly the different kinds of field-bugs, which penetrate into them with their rostrums or beaks, and suck their juices. When the caterpillars have become larger, or nearly fully grown, the ichneumon flies pierce their bodies, introducing at the same time their eggs, so that instead of a moth coming out of the pupa, an ichneumon fly is produced.

These caterpillars suffer less from small birds, apparently on account of the thick hairs on their backs; which probably cause a burning and itching in the throat or stomach, and as they affect the hands in the same way, they should be taken hold of with great caution, or rather never touched without gloves. Heavy or continued rain is very destructive of the moth itself when it is laying its eggs; for as it sits exposed upon the leaves, it is easily washed off by the rain, when it perishes on the ground. In this manner it often happens, that though a great many caterpillars of the golden-tailed moth may appear one year, there will be much fewer of them in the next; the greater part of the moths having perished from unfavourable weather.

Notwithstanding the numerous reactions in nature to prevent the excessive increase of these caterpillars, they are frequently very numerous, and are very injurious to our fruit-trees; as in the year 1828, and partly in 1829. We should therefore contrive means to protect ourselves from them; though indeed we already possess those means, and know how to apply them if we are not wanting in diligence. We can destroy the eggs, kill the caterpillars soon after their birth, collect the pupæ at a later period, pursue the moth in July and August, take their nests from the trees in autumn and spring, and seek out and destroy the half-grown caterpillars in their new webs in May.

Destroying the eggs can only be effected on dwarf and low fruit trees. The eggs, as we have observed, are in a mass covered with gold-coloured hair, and therefore not easily overlooked, particularly if they are searched for in July, when they are newly deposited by the moth. Should all the masses of eggs have escaped our observation, yet the caterpillars which issue from them cannot long remain concealed, as they leave the traces of their arrival on the shoots, by eating the leaves and only leaving the nerves. As they keep close together at first, and collect together again at night, they may be taken all at once if the shoot whereon they are encamped be cut away and taken out of the garden.

The seeking for and destroying the eggs and young caterpillars on lofty trees, is however not easily accomplished; but it is not so difficult to look for and remove the pupæ. I have already observed that the caterpillars are fond of the damson-tree for undergoing their transformation in, and therefore if any of these trees are growing among or near the lofty apple or pear trees, let them be searched in the latter part of June for the balls which these insect have made for their retreat while in the pupa state. If there are no damson-trees in the garden, let the drooping branches of the pear and apple trees, particularly of the latter, be examined; as the caterpillars usually descend to the lower branches, to undergo pupation. How much the labour of clearing trees of caterpillars in autumn and spring might be lessened, if people would but take the trouble of looking for the insect in the pupa state!

Should the pupa however escape observation, the moths that have escaped may still be easily destroyed; at least those on the dwarf trees, as they sit quietly throughout the day on the leaves and twigs, and may be taken by hand. Although the remedies here mentioned tend much to diminish the yellow-tailed moth, yet the removing the caterpillars from the trees * is not to be dispensed with, for we can never find all the pupæ, nor catch all the moths. Or even if we should be able to accomplish this in

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* It is sufficiently proved how much further the science of Entomology is advanced abroad than in our own country, by the simple fact that both in Germany and France, a single word is employed to express the *taking away the caterpillars* from trees. The term *abraupen* in Germany, and *décheniller* in France, are both singularly expressive; we should perhaps make a new English term, "*to uncaterpillar* the trees."

our own gardens, moths would come from other districts and even from woods, which would cover our trees with their descendants. There will always therefore be caterpillar nests found on our fruit-trees, in years favourable to this insect, from which the trees must be cleared. They are removed either with the hands, or with the *wurmscheere* (literally caterpillar shears) * ; but the former method is to be preferred when practicable, as by it the tree remains uninjured. In those cases when the warmscheere must be applied, it should be used in such a manner as to cut away no more of the shoot than is absolutely necessary to remove the nest; and care should also be taken not to splinter the shoot, as is often done in breaking off the part infested, as when this is the case the tree must either be left unsightly, or lose more of its wood than is necessary.

That the removing the caterpillars or their nests may be of real service, it is requisite first that it should not take place before the middle of November, for as we have seen, the little caterpillars only finally retire into their nests in November, and become torpid; secondly, that the removing the caterpillars should be finished at latest in the latter part of March, or still earlier, if warm sunny weather has set in, because the young caterpillars leave their nests immediately that the buds begin to swell; thirdly, that the nests, whether removed from the trees late in autumn, during winter, or in spring, should be carefully collected, and removed from the garden, for if they be allowed to remain, the young caterpillars will creep out again in the spring, find out the fruit-trees and attack the buds. Although the nests lie on the ground the whole winter, covered with snow and ice, or exposed to frequent and continued rain, the caterpillars within are not in the least injured. If the nests are suffered to lie on the ground, they are indeed more dangerous to the fruit-trees than if they had been left on the branches, for as the caterpillars feel the influence of heat sooner when lying on the earth than on the tree, they will be sooner revived from their torpidity, and in fact will creep out before the buds have begun to open. Woe to the dwarf, or young tree, that is attacked by them in this condition! No sooner have they reached the tree than they spread themselves all over it, and attacking the buds in succession eat them entirely off. Trees thus roughly treated make no shoots in the spring, and they do not form fresh buds till the following June. As the ants frequent the hollow buds (of which the caterpillars have eaten out the heart), for the sake of the sap flowing from them, the blame is laid to them; and measures are taken for their destruction, while the caterpillars have by this time left the tree unperceived, and commenced their attacks upon another.

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* This instrument (wurmscheere) is figured and described in the *Gardeners' Magazine*, vol. i. p. 325, under its French name of *échenilloir*.

We must observe finally that the orchards should be carefully examined from time to time, particularly throughout May, to see that there are no caterpillars here and there on the branches; for whatever pains may have been taken to remove them, some must always escape, more particularly if the operation took place too early in autumn, or too late in spring. Sometimes a nest or two is overlooked among the grass; and sometimes a few having separated from the common society, have made their nests in single leaves, where they have passed the winter unobserved. If a few caterpillars have escaped in this way, it is not difficult to find them in May, if the stem and branches be closely examined, especially at the forks. As the caterpillars always make a web before their last moulting, and as this may be seen at a distance, they cannot long remain concealed.

If these remedies were applied by all proprietors of fruit-trees, their orchards would unquestionably be preserved for a number of years free from this insect; for when the yellow-tailed moth has, by whatever means, suffered an excessive diminution, many years pass before it again becomes numerous and dangerous to fruit-trees. But how few there are who even attempt to destroy this insect in all its stages! Even the universally recommended and effectual operation of *uncaterpillaring*, or of clearing the trees of the caterpillars, is neglected by many proprietors of orchards. These indolent proprietors deserve to lose their fruit, and to see their trees lose their vigour, but unfortunately the effects of their negligence is felt by their neighbours. It is much to be desired, therefore, that every proprietor of trees should be forced by the government to remove the caterpillars from his trees, and that those persons should be called to an account, from whose neglect their neighbours' fruit-trees have suffered injury *. [Schmidberger.]

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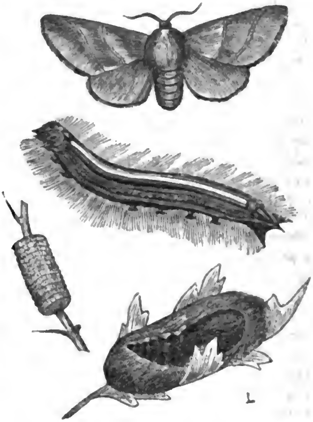
* In addition to the remedies suggested by Canon Schmidberger, I would insist more particularly upon the destruction of the perfect insect; conspicuous as it is in a great degree from its snow-white colour and comparatively large size, and at the same time, easily as it may be caught from its exceedingly sluggish habits, nothing would be easier, when the moths *first appear*, and before they have had time to pair and deposit their eggs, than for the trees upon which they abound to be well beaten or shaken, to knock off the insects into a sheet spread on the ground. The latter would be better, because the former would perhaps also knock off some of the fruit; but even that would be to be preferred, rather than the fruit-trees should become the abode of the colonies of this moth.

In our own country, another species of the same genus, not mentioned by Kollar, has occasionally been exceedingly destructive. It is the ***Porthesia auriflua***, Stephens, ***Bombyx auriflua***, Fabricius, ***Bombyx phæorrhœa***, Curtis, or the brown-tailed moth. In the summer of 1782 especially, this insect created great alarm over the country from its multitudinous colonies, which were so immensely numerous, that we are informed by Mr. W. Curtis (who published a treatise on it), that in many of the parishes near London, subscriptions were opened, and the poor people employed to cut off the webs at one shilling per bushel, and which were burnt under the inspection of the churchwardens, overseers, or beadles of the parish; and some idea may be obtained of their numbers, from the fact, that at the first outset of this business, eighty bushels were collected in one day, in the parish of Clapham. But the mischief was not confined to the actual destruction of the vegetation, but the most absurd alarms were raised from the sudden appearance of these creatures, which by some were regarded as the forerunners of the plague; by others, as the actual cause of it; and by some, that the destruction of every kind of vegetable would follow. Prayers even were offered up in some of the churches to deliver the country from the apprehended approaching calamity.—(Curtis, *History of the brown-tailed moth*, 4to, London, 1782.)

According to Curtis, the caterpillar of the brown-tailed moth is found "on the hawthorn most plentifully, oak the same, elm very

THE LACKEY, OR BARRED TREE LACKEY MOTH. *Bombyx (Gastropacha) neustria. Clisiocampa neustria*, Curtis, Stephens.



BOMBYX NEUSTRIA, WITH THE SPIRAL MASS OF EGGS, CATERPILLAR, AND CHRYSALIS IN ITS COCOON.

The caterpillar of the lackey-moth is one of the most dreaded enemies of the orchard, and is the more worthy of the notice of gardeners, as it attacks almost all kinds of trees, both evergreen and deciduous; such as pines, beeches, elms, poplars, &c., with equal fury. It also appears almost every year in considerable numbers. However numerous the caterpillars may be on the fruit-trees, yet the perfect insect or moth is seldom seen, as it only flies at night, and conceals itself by day among the leaves or in the long grass.

This moth is of the middle size, and somewhat resembles the silk-worm moth, *Bom-*

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plentifully, most fruit-trees the same, blackthorn plentifully, rose-trees the same, bramble the same, on the willow and poplar scarce. None have been noticed on the elder, walnut, ash, fir, or herbaceous plants; with respect to fruit-trees, the injuries they sustain are most serious, as in destroying the blossoms as yet in the bud, they also destroy the fruit in embryo; the owners of orchards, therefore, have great reason to be alarmed."

This moth is so closely related to the yellow-tailed moth, and its habits so similar, that the means suggested for the destruction of the one, may be advantageously adopted for the other.

byx mori. The male, which is usually smaller than the female, measures with expanded wings, from tip to tip, from one inch to fifteen lines. The ground colour of the whole insect is either light yellow, or reddish-yellow ochre. The upper wings have always a darker band in the middle, which is bordered by two lighter cross lines; the fringes are whitish, and brown spotted. The under wings are always of a uniform colour, either light yellow or brownish, according as one or other of these colours predominates in the whole insect. The antennæ are strongly pectinated in the male, but less so in the female; the latter has a thicker abdomen.

The time of the appearance of this moth is usually the month of July, and the female lays her eggs immediately after pairing, in the form of a broad ring round the twigs of the trees, from which they are scarcely to be distinguished, owing to their similarity of colour. This ring contains from two hundred to three hundred and fifty eggs, which from their firmness defy their enemies, as well as the severest cold. In spring, the caterpillars are developed about the end of April, or beginning of May; and they live in society till the third moulting. They are usually met with early in the morning, or on rainy days at the forks of the twigs in a large nest closely spun over with a silky substance, to the number of from fifty to two hundred together. When they are disturbed, they let themselves down by threads to the ground and disperse. In the month of June, the caterpillar is fully grown; it is often one inch in length, soft, and thinly haired, striped with blue, red, and yellow*, with a white line down the back. The head is bluish gray, marked with two black spots. It spins for itself, generally between two leaves, a slight oval web; powdered with white or yellow dust, in which the longish dark brown pupa, which is also covered with powder, reposes for three or four weeks.

Many steps may be taken against this insect, particularly in the caterpillar state, before the third moulting; that is, in the month of May, when it is still gregarious: it is only necessary to crush the whole colony with a stick, or to sweep them down into a pot and destroy them. From the middle of June, and during the whole of July, search should be made for their cocoons, which will be found either fastened between two leaves, on trees or shrubs, or lying in the roofs of houses, on the tops of walls, or in hedges; by squeezing or treading on these cocoons, an end will be put to their future progeny. On low fruit-trees, the rings of eggs may be discovered after some practice, when the leaves have fallen off; and when found, they must be removed from the tree and burnt, but not allowed to fall on the ground.

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* Hence the fanciful English name of lackey, given to this insect, from the stripes having somewhat the appearance of a footman's coat.

Their natural enemies are Ichneumon flies, and the splendid green and bronze-coloured beetles, *Calosoma sycophanta*, and *Calos. inquisitor*, which are frequently seen running up and down the fruit-trees.

THE GIPSY MOTH. *Bombyx* (*Liparis*) *dispar*, Autor. *Hypogymna dispar*, Hübner, Stephens.

In the first days of spring, another caterpillar is seen on fruit-trees, feeding on their leaves; this is the larva of the Gipsy-moth, which is in Germany named grosskopf (great head) from its unusually large head.

Early in April, before the leaves are fully out, the little caterpillars are hatched, and spread over the bursting buds. In unfavourable weather, they collect upon the trunk near the top, or in the forks of the branches, and enclose themselves in a web; but when they feed, they disperse themselves all over the tree. They are immediately distinguished from other caterpillars by their large yellow-spotted head; and by the six pair of red dots on the hinder part of the back. They have tufts of hair on each side of their bodies, and single hairs on the back. After moulting, a pair of blue tubercles appear on the fore part of the back; that is, on each of the first four segments of the body, by which they may be identified at once. They are very voracious, and therefore very injurious. This is particularly the case in gardens in towns, where they are a complete scourge to dwarf trees, which they often entirely defoliate, when favoured by the weather, and not attended to. Towards the end of June, the caterpillars are full grown, and they then look out for a quiet place, usually on the fruit-trees, to form their cocoons, where they are transformed into a reddish pupa.

The moth appears in August. The males are dark brown, and their fore-wings have three or four undulating blackish stripes; the females are whitish grey, and their fore-wings are traversed by brownish stripes. The males are much less than the females, whence the specific name *dispar*, that is, unlike, has its rise *. The moth lays her eggs in various places in August and September, but chiefly on the trunks of the fruit-trees, on which the caterpillars lived. It also lays its eggs in places that are not very near fruit-trees, viz. on garden buildings, palings and walls, so that the young caterpillars have to go a considerable distance in search of food, which is seldom the case with insects. The eggs lie in a shapeless mass, one inch long, and a quarter of an inch high, to the number of two to five hundred together, and are surrounded with yellowish hair, which preserves them from the winter's cold. In the spring, as we have observed, the eggs are hatched, when the young caterpillars creep out and soon discover the fruit-trees, although they must pass over a considerable space to reach them.

With respect to destroying these insects, the first thing that is necessary is to find out the egg-masses and destroy them. As they are very large and usually in open places, we cannot avoid seeing them if we look carefully, which should be done in September and throughout the autumn; or early in spring, before the caterpillars are hatched. In August we can take the female moth herself, as she likes to sit on the trunk of the fruit-trees and is easily caught. In spring when the fruit-trees come into leaf, we must carefully examine them on account of the various other caterpillars; when, no doubt, this species will also be observed. As the caterpillars are very fond of lying on the trunks of the trees when they are nearly full grown, they are easily discovered and may be killed, together with the lackey caterpillars which have the same habit. [Schmidberger.]

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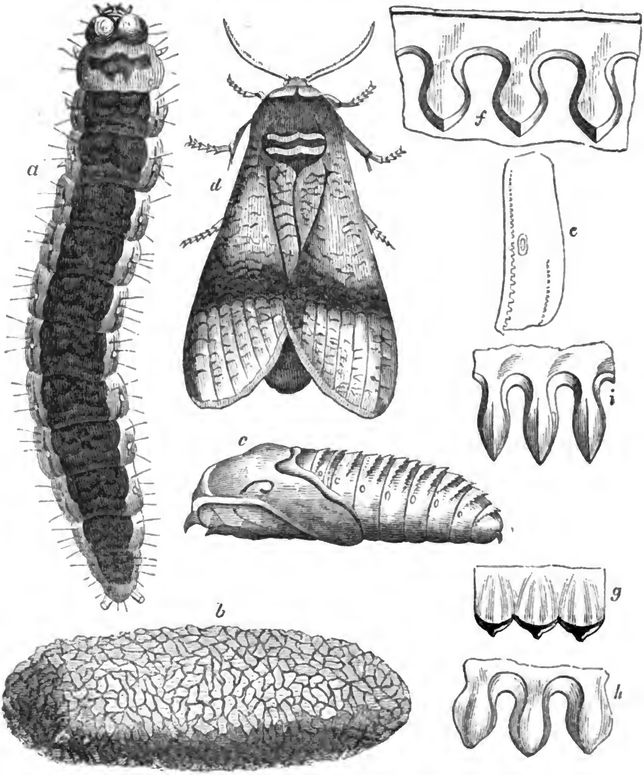
* Rather from the difference in the colours of the sexes.

THE GOAT MOTH. *Bombyx* (*Cossus*) *Ligniperda*, Autor. *Bombyx Cossus*, Linn.

The caterpillar of the goat-moth is no less the dreaded enemy of various sorts of fruit-trees. The caterpillar of this moth does not live on foliage like most of the larvæ of butterflies, but on wood itself, and causes the destruction of the tree (particularly if it should be young), either directly by its voracity, or by rendering the wood so soft and rather rotten, that the tree is blown down even in a moderate gale.

These insects always live deep in the interior of the tree, and betray their presence only by the rejection of their excrement, which consists of very minute chips of wood, and by the worm meal (dust caused by their excavations) being observed on the trunk. They seldom leave the tree they have attacked, and in general only when they do not find sufficient nourishment, or when they are disturbed by any enemy. They then seek another tree which pleases their palate. On such occasions the caterpillar is sometimes caught.

It is one of the largest species known in Europe, measuring more than four inches in width. It is smooth and shining, beset only here and there with single short hairs. It is dark red on the back, and the spiracles situated at both sides are of the same colour. The sides and lower part of the body are flesh-coloured; the head is black, the first segment also marked with black above. It has very strong organs of manducation, by means of which it can masticate the hardest wood, being found even in elms and oaks, although the various sorts of willows, poplars, walnut, and other fruit trees, seem to be its favourite food. It discharges a corrosive fluid at its persecutors, which causes pain; it also diffuses an extremely offensive and peculiar smell, so that we have



GOAT MOTH.

a. larva. *b.* cocoon. *c.* pupa. *d.* perfect insect—*e*, *f*, *g*, *h*, and *i*, are representations, magnified, of the spines upon certain of the abdominal segments—*e*. represents the fourth abdominal segment, seen laterally. *f*. three of the basal row of spines. *g*. three of the hinder row of spines. *h*. three of the basal row of spines of the ninth abdominal segment.

much reason to doubt whether this caterpillar is the real *Cossus* of Pliny, which was considered in his time so great a delicacy at the tables of the Romans. At any rate, it is the insect which the celebrated Lyonnet has made the object of his anatomical experiments; and of which he has published such admirable representations of the internal and external formation. He found no less than 228 muscles in the head, 1647 in the body, and 2186 in the stomach and intestines; in all 4061.

After remaining more than two years in the larva state, and casting its skin eight times, the caterpillar becomes of a light ochre-yellow hue shortly before pupation, which usually takes place in spring, when it makes a strong cocoon of chips of wood, and small pieces of bark which it has gnawed off. The abdomen of the pupa is yellow, and the segments are deeply indented and capable of much extension. The back is furnished with strong, pointed spines, sometimes black and sometimes of a reddish brown colour. The cocoon is situated immediately within the opening in the tree, so that the pupa when arrived at maturity can press itself half out of the hole when the shell bursts, and the moth comes forth usually in the month of June or July, after having reposed in the pupa state for an indefinite time.

When at rest, the moth's wings are folded together over the back in the form of a roof; it sits quietly in the daytime on the stems of trees, and is difficult to be distinguished on account of its grey colour. It measures, with extended wings from one tip to the other, nearly three inches, and many specimens are more than this; the female is usually larger than the male. The head and collar are whitish grey, the latter bordered with yellow; the back is brownish grey, mixed with white at the end, surrounded with a black scolloped transverse line; the abdomen ash-grey, with light grey segments. The antennæ have a light grey shaft, and black rays, but are more strongly feathered in the male.

The fore-wings are of a dingy grey, clouded with blackish brown, and are traversed like net-work by innumerable blackish brown cross-lines, of which two broader stripes towards the outer border are particularly conspicuous. The hinder wings are dark grey, and checkered like the anterior pair, but fainter.

The female is provided with a strong ovipositor, with which she introduces her eggs into the bark of the tree; the young caterpillars living at first in and between the outer and inner bark, and afterwards, when they are stronger, penetrating into the wood. More than a thousand eggs have been counted in a single female, hence we may suppose that powerful enemies conduce to the destruction of this insect at an early period of its existence, perhaps even in the egg state, otherwise our fruit and forest trees would be much more injured by this caterpillar than they usually are. It is difficult to apply any remedies for the extirpation of these destructive enemies of trees, as they keep themselves concealed from our view deep in the stem. When we have actually ascertained the existence of one of these creatures in a trunk by the extruded excrement, relief comes too late for the tree, even if we are able to kill the caterpillar, the mischief being already done. Notwithstanding this, the caterpillar should never be left undisturbed, and an attempt should be made to reach it, by enlarging the opening with a garden knife; or endeavour to kill it by thrusting a piece of pointed wire up the hole of the tree. By this means, at least the other as yet uninjured trees will be protected from similar attacks *.

THE WOOD-LEOPARD MOTH. *Bombyx* (*Cossus*) *Æsculi*, Autor. *Zeuzera Æsculi*, Latreille and Stephens.

The Wood Leopard Moth (called in Germany, *Rosskasntanien-spinner*, Horse-chesnut moth, but somewhat improperly so named, as it chooses the horse-chesnut less frequently for its abode than any of the other trees that serve it for food) lives in the neighbourhood of Vienna, chiefly in elm, walnut, pear, and apple-trees, and injures their trunks in the same manner as the Goat Moth Caterpillar, to which it perfectly assimilates in its habits.

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* The blowing of tobacco smoke into the holes made by these caterpillars, would probably not be without effect in dislodging them. Moreover it would be serviceable to search for the moths so soon as their arrival in the winged state shall have been made apparent by the chrysalis cases sticking out of the trees, in the months of June and July. .(See *Gard. Mag.* and *Arb. Brit.*)

The caterpillar of this moth is smaller than that of the preceding species, its length being only one inch and a half or two inches. It is hatched in August, moults for the first time in September, and is full grown in June of the following year. From its first existence till its transformation it is yellow, with raised, shiny black dots, on each of which there is a fine short hair. There are two black spots on the head; the plate on the first segment is broad, arched, and shining black, as well as the last segment.

It undergoes its transformations in a strong web under the bark, becoming a brownish yellow pupa capable of much extension, dark brown at both extremities, with short wing-sheaths, a horn-like point bent forwards on the head, and fine hooks on the back of the abdominal segments.

The moth appears in August, towards evening, and is a native of almost all Europe. It is very remarkable from its colour; the ground is white, on various parts of which steel-blue dots are scattered. It measures, with extended wings, two inches and a half. The antennæ are black, in the male doubly pectinated to the middle, the rays black, and forming an oval brush; from thence to the tip very finely notched; in the female they are filiform, clothed with fine down from the base, then minutely notched. The head and back are white, the latter with six blackish blue dots in two rows; the abdomen is blackish blue, with whitish down in the articulations and sides. The male is considerably smaller than the female, the latter has a projecting brown ovipositor at the end of the body. The wings are thinly scaled, shining white, the anterior pair lancet-shaped and covered with innumerable black, blue, or green spots and dots. On the posterior wings they are fewer and more indistinct, the outer edge is bordered by a row of dark blue dots as far as the inner border, which is quite white. The under side does not differ from the upper. The female introduces her round, orange-coloured eggs, by means of her strong ovipositor, into the trees before-named.

The same means are applicable for the destruction of this insect as were mentioned for the Goat-moth.

THE FIGURE-OF-8 MOTH. *Noctua* (*Episema*) *cæruleocephala*, Autor. (*Bombyx cæruleocephala*, Linn.)

The caterpillars of the figure-of-8 moth, are associated in many years with those we have just described, and contribute not a little in defoliating the trees. They prefer the leaves of the almond, apricot, and peach trees, but do not reject the foliage of other fruit trees. They are usually met with singly on the twigs, but their thick fleshy bodies sufficiently prove that they require no inconsiderable supply of leaves for their support.

In the month of June, when almost full grown, this caterpillar measures nearly two inches, and is of the thickness of a very thick quill; it is very juicy, of a yellowish green colour, with black tubercles, each of which bears a single hair, and has three pale yellow stripes running longitudinally, the middle one extending rather broadly along the back. It has a small bluish head, with two black round spots on it. On the first segment, between the under lip and the fore feet, is situated a fleshy horn. There are also bluish green varieties. When young it is lighter, and is often nearly white on the back; when old, on the contrary, it becomes of a bluish colour.

At the time of pupation these caterpillars repair to the stems of the trees, or to walls and hedges, where they make for themselves cases of moss, lime, dust, and small chips of wood, oval on the upper side and flat below, in which they do not become pupæ till the third week. The pupa is small, cylindrical, reddish brown, dull, in some degree powdered with blue. The duration of the pupa state is usually three months, more or less, so that the moth appears in

October and November, and sometimes not till the following spring.

The perfect insect or moth measures with extended wings from tip to tip, one inch, and from six to nine lines. The bluish grey, rather shining, fore-wings have evanescent cloudy spots. The whitish-yellow spot in the middle of the fore wings, which is divided by three incisions at the sides, and is situated between two blackish, undulated cross lines, has been sometimes compared to a double kidney spot, and sometimes to a pair of spectacles (or a figure of 8.) A white wavy line, not very distinct, forms a small white spot behind the second stripe at the anal angle. The toothed external edge has ash grey shining fringes bounded with a line. The under-wings, which are ash grey, have a dull middle spot, and an indistinct band, with a small black streaky spot at the anal angle. The colour of the antennæ, which are pectinated in the male, and filiform in the female, is rusty brown.

The thorax above is the same colour as the fore-wings, and the abdomen with the extremity of the body (which in the male has a tuft of hair, in the female is cylindrical and downy) is of the same colour as the hinder wings. Immediately after pairing, either in autumn or the following spring, the female lays her semicircular, furrowed, light-green eggs singly on the trees.

As the caterpillars, particularly when they appear in great numbers, seriously injure the fruit-trees, they undoubtedly demand the attention of the gardener. There is no other effectual way of diminishing or destroying them but by hand-picking as soon as they appear. This can be best accomplished in rainy days, when they take refuge under the branches and on dry places of the stem. It is difficult for an unpractised eye to find the pupæ, as they are covered over, when on the stems of trees, with moss, or minute pieces of bark, in the hedges with chips, and on walls with mortar ; yet with some degree of attention their presence can be detected by their rather elevated oval form, and they may be destroyed by the application of the garden-knife, or a piece of wood. They are much relished by some birds on account of their fleshy rather smooth bodies, and several Ichneumon flies and tree-bugs essentially contribute in thinning their numbers*.

THE LUNAR SPOTTED PINION MOTH. *Noctua* (*Cosmia*) *pyralina*, Autor.

As I have frequently met with caterpillars of the lunar-spotted pinion moth (*Noctua pyralina*) on fruit-trees, and as they are very voracious, it appears to me that they ought to be included in the number of insects injurious to them. These caterpillars are rather thick and fleshy, light green, with a whitish stripe along the back, and with two darker lines along the sides. On the segments are whitish-yellow warts furnished with fine small hairs. Over the feet and along the first three segments runs a yellow stripe bordered with black.

As soon as the fruit trees are in leaf, the caterpillars are found on them in company with those of the winter moth; and they are particularly abundant on the apple-trees. In 1835 they were so numerous that I took every means of destroying them. They are fully grown about the end of May, and become pupæ of a blue-frosted appearance, on the trees themselves.

In a few weeks the moth comes out; the fore-wings are brownish red, almost copper colour, traversed by several undulating, dark brown transverse lines. The fore-wings are distinguished by a whitish, partly obliterated semicircular spot, situated nearly at the tip of the wing; near to this, almost at the outer edge, is a rather largish black spot. The under-wings are light grey, rather darker towards the fringes, which are yellow.

As these caterpillars, like various looper-caterpillars, live scattered upon the trees, they are not easily found and removed. But as they are rather thick and unwieldy, they are easily thrown down by shaking the branches. The moths also usually fall from the tree if the branches are struck in June and July with a wooden pole. By this process I have freed my trees in pots, and the tall-stemmed young apple-trees in the nursery. At the same time different looper-caterpillars and other insects which feed on the leaves of fruit-trees fall down. [Schmidberger.]

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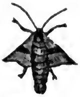
* In England the caterpillars of this moth, which is very common, are generally found in hedges, feeding more especially on the black-thorn and white-thorn in preference to fruit-trees.

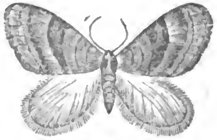
THE WINTER MOTH. *Geometra (Acidalia) brumata*, Autor. *Cheimatobia brumata*, Stephens.

The most ruinous insect for fruit-trees is assuredly the green looper-caterpillar, which is produced by the winter-moth.

This moth has its name from its appearing late in the autumn or winter, for it is not usually seen in the garden till November. It proceeds from a light brown pupa, which lies from June to the end of October either a few inches under the earth, or under stones and clods. There is a great difference between the male and female. The male is, like most moths, winged; but the female has only short rudiments of wings, which are quite unfit for flying. The male is delicately formed, has a yellowish grey body, and pale grey wings, traversed with delicate cross lines somewhat darker. The female has a much thicker body of an ash grey colour, with the rudimental wings of the same colour, which are traversed by a cross stripe and very long feet.



FEMALE.



WINTER MOTH.
GEOMETRA BRUMATA.

Towards the end of October the male moths are seen fluttering about the garden. The females make their appearance soon after them ; in the neighbourhood of St. Florian they are very numerous on the fourth or fifth of November on fruit-trees. The winter moth is a nocturnal Lepidopterous insect, it sits quietly in the daytime in one place, but it becomes active in the twilight, when it flies about the garden in search of a companion ; the female is generally found on the stem of a fruit tree, and there pairing usually takes place. The female ascends immediately to the top of the tree, and lays her eggs singly, partly on the fruit and leaf-buds, and partly on the ripened wood and twigs, or on leaves that are firm on their stalks. The eggs are light green, very small, and scarcely perceptible to the naked eye. There are generally a great many of them, one moth often laying more than two hundred. They are so firmly glued to the bark, that they cannot easily be washed off with rain, nor does the severest winter destroy their vitality.

The caterpillars are hatched in spring as soon as the buds on the trees begin to push out, for the warmth which causes the sap to flow calls them also into life. Hence the longer it is before the warm weather of spring sets in, and the later the trees are in budding, the longer will these caterpillars be retarded, that food may be ready for them when they make their appearance. At first they are of a grey colour, but afterwards they become light green. They are called loopers because, having no ventral feet, they are obliged to advance the anal pair as far as the fore-feet, thus making a bow or ring to enable them to move forwards. As the caterpillars are very delicate at first (scarcely as thick as a horse-hair, and almost transparent), their food is equally so, consisting of the fine tips of the leaf-buds and calyxes. As they require but little food their traces are not easily seen, and consequently they are difficult to find. It is only by closely inspecting the blossom-buds that a fine web is perceived between the enveloping calyx and the bursting blossom, in which they lie concealed, and protected from cold. As soon however as the petals become visible, they gnaw away into them, while others penetrate the unfolding leaf-buds. But whether they choose the blossom or leaf-buds for their dwelling and nourishment, they glue the parts together in such a manner that they are prevented from expanding properly. These insects chiefly betray their presence in this manner, and we have only to separate the buds thus closed to get at them.

It is not always, however, that a looper caterpillar is found on separating the blossom and leaf-buds; we frequently find that other little worms or grubs have glued them together to conceal themselves within. Sometimes we meet with a reddish grub, which is the caterpillar of the red *Tortrix luscana*, or a dark green, black-spotted, rather thick caterpillar, which is the grey *Tortrix cynosbana*. These larvæ retard the unfolding of the leaf and blossom-buds, and must not be allowed to remain either on or in them; but if we meet with a light green caterpillar, with a black head, and without ventral feet, it is the green looper of the winter-moth.

When the blossoms begin to unfold, some of these caterpillars bury themselves in the petals, and others descend to the receptacle to find food and shelter; while those which can get no blossoms, penetrate and make their way into the centre of the unfolding leaf-buds, and take up their abode there. When the fruit is formed it is their favourite food, and they eat it almost entirely, so that only the stalk or part of the core remains. They then return to the leaves, eating at first the more tender ones, then, as their bodies become stronger, the remaining leaves, particularly when the insects are very numerous. As these caterpillars destroy their houses by their voracity, they are obliged, in order to make fresh ones, to have recourse to the withered skeletons and stalks of the leaves they have eaten. They glue these together in the shape of a ball, and seek protection from rain and cold within. There they devour the remainder of the buds, which is extremely injurious to the tree, as by doing so they completely destroy the spring shoots. These small balls or masses, on the leaves and shoots, give them the appearance of having been scorched; and nothing green is now to be seen on the tree. The caterpillars therefore leave it and take possession of another. When they cannot find any more food on the neighbouring trees, they bury themselves in the earth for pupation, if they have nearly attained their full size, or they die of hunger; as was the case in 1827, when many thousands perished for want of food. Even of those which enter the earth under these circumstances, many do not attain their final change; as for want of sufficient nourishment they had not previously attained that maturity which is necessary to their being transformed into moths. Fruit trees which have been eaten bare in this manner do not recover for a long time. Old sickly trees often do not begin to come into leaf again till the end of June, and generally produce leaves only at the tips of the twigs, but make no shoots. They are at the same time so weakened that they usually die, if a severe winter follows. Young trees full of sap sometimes begin to grow rather earlier in June, but making short weak shoots, which do not ripen unless the weather chance to be favourable in autumn. Blossom-buds cannot indeed easily be formed on the denuded trees, because when the sap begins to flow for the second time, that is, about the 24th of June, the blossom-buds will be brought prematurely into action, and will shoot out into leaves, instead of being matured into blossom-buds. If these green *loopers* find sufficient nourishment on the fruit-trees, and if very unfavourable weather does not set in, they remain on them till they are full grown; that is, generally from the middle to the end of May. They then let themselves down by means of a thread spun from their mouth, and become pupæ in the earth. Some are observed leaving the trees as late as June, and going into the earth. These have no doubt been produced from moths that only came out of the earth in spring, to continue their species. The Winter Moths do not all appear in autumn, but many of them lay their eggs on the trees in the following spring. These eggs cannot be so soon hatched as those laid in autumn; indeed the caterpillars are often hatched from the latter when the parents of the former begin to appear on the trees. Hence we sometimes see very small caterpillars even at the end of April or beginning of May, which attain their full size and become pupæ at a much later period; and it seems to be those only which remain in the pupa state in the earth throughout the winter, and appear as moths in the spring.

As the devastation caused by these caterpillars to our orchards is so considerable, we must seriously consider how to put a stop to it. Nature has indeed provided several means of diminution, which are often so effectual that our fruit-trees remain uninjured by this insect for several years.

The greater number of the winter moths, as before-observed, begin to appear about the end of October or beginning of November, and a few in spring; and if they are then exposed to continued wet or stormy weather, thousands of them perish *. Also if frost or snow sets in early in Nov. when they are emerging from the pupæ, they cannot reach the surface of the earth, and must of course perish; if continued rainy weather also ensues in spring, when they are moulting for the second or third time, and dispersed over the leaves, many of them become sickly and die, or they leave the tree before they are sufficiently grown. In flat gardens the pupæ often perish, if heavy showers fall in summer, as the water not having sufficient drainage, penetrates into the earth, and reaches the pupæ; which, as we have said, lie near the surface, or under clods and stones. For this reason but few *looper caterpillars* are found in the orchards on the low banks of the Danube; because they are exposed to the occasional overflowing of the river, and the pupæ are destroyed by the water penetrating into the earth.

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* Although ants may not be injurious to apples and pears, the brown garden ant is certainly to be numbered amongst the enemies of the fruit of the peach and nectarine tribes, being exceedingly fond of the ripe fruit, into which they eat their way, devouring the interior of the fruit with great avidity. Numbers, indeed, may sometimes be found in a single apricot which has been suffered to remain too long on the tree. I have found the best plan of extirpating these insects, is to destroy the winged males and females at the time of swarming.

Many of these caterpillars become a prey to insects; even ants, which are considered the enemies of fruit-trees, contribute much to their decrease. If a person stations himself under a fruit-tree where these caterpillars are numerous, in May, particularly after rain, he will see one ant after another hurrying down the stem, each with a caterpillar in its mouth. In general ants should be considered as more beneficial than injurious to fruit trees, and should only be persecuted when they make their nest under the root. In this case it is easy to drive them from their resting-place, by clearing away the earth on one side till their eggs are visible, and repeatedly pouring water over them. In a few days no more ants will be found there. As the injury they do to the fruit on other occasions is of no importance, I cannot introduce them here as enemies to fruit-trees *.

These green caterpillars are much relished by the small birds; they search for them everywhere, and devour multitudes. As these caterpillars are most plentiful in spring exactly at the time when the small birds have young ones, it may easily be imagined that vast numbers are consumed. The titmice require the most, as their broods are usually very numerous, each consisting of from eight to fourteen young birds, according to the species of titmouse to which it belongs. How careful ought we therefore to be of small birds, which assist us so industriously in clearing our fruit-trees of these destructive caterpillars!

At the time when the small birds are thus strikingly diminishing these insects, it is of the utmost importance that children should be impressed by their teachers with the necessity of leaving their nests undisturbed. Proprietors of trees in towns and in the country should prevent the titmice from being taken in their gardens, and foresters and park-keepers should not allow any bird-traps in the woods and preserves.

The means of diminishing this insect, existing in nature,

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* Mr. Stephens states that he once met with a ditch in Epping Forest, of which the water was covered with myriads of specimens which had been drowned.

are, however, not equally effective every year; so that sometimes the numbers of the caterpillar increase to such a degree that the produce and vigour of our fruit-trees would be alike destroyed, if we did not take measures against them. We can, at least, prevent the females of the winter-moth from reaching the top of the tree and laying their eggs there. We know that they have no wings, and consequently can only crawl up the trees; therefore if we can place any contrivance round the trunk of a tree, over which they cannot pass, that tree is secure from them. No eggs can be laid there, and consequently no caterpillars will be found there in spring. Everything has been tried to keep off the female winter-moths from the fruit-trees: the stems have been surrounded with tow, cotton, fir-twigs, ears of corn, and substances having a disagreeable smell; but they have passed all these barriers and reached the tops. They have been even known to pass worsted threads prepared with mercurial ointment and wound round the trees, as many amateurs of gardens have experienced. The stem of the fruit-tree has also been surrounded with strong paper, fastened with packthread, and smeared with tar, or cart-grease. This was so far effectual that the moth stuck in the tar. But as this substance either loses its stickiness by the rain or dries quickly up, the smearing must be repeated daily, to render it effectual; and this would be both tedious and expensive. If the tar be too thickly laid on, it flows from the paper on to the stem and injures the bark. Therefore those persons give us very bad advice who say that the stem itself of the tree ought to be smeared with tar, to prevent insects from reaching the top. The tar even penetrates through the bark into the wood, and destroys the sap vessels, by which young trees are greatly injured. At last a plan was thought of, of surrounding the base of the stem with a wooden frame, or box, and daubing it on the outside with tar to avoid the bad effects mentioned above. This contrivance completely answers the end in view, as has been fully proved. The frame consists of four boards about a foot high, and rather longer than the diameter of the tree they are to surround. These four boards are to be nailed together in the form of a square open box; but the fourth board is not to be fastened on till the frame is placed round the tree, as the stem must be entirely enclosed by the boards. To prevent the sun or rain from having any effect on the tar or cart-grease, the top of the frame is to be surrounded with a moulding; that is, a thin piece of wood three or four inches broad is to be nailed on the top, so as to form a projection on the outside, and under this an angle. This angle, formed on the outside only, is to be thickly smeared with tar. This frame may thus be called a boot, as the stem of the fruit-tree stands as if in a boot. It must be set an inch deep in the earth, which must be well trodden in round it, so that the moths may not get under it and reach the tree. I must here observe that the boot ought not to be made too large; but should be so fixed as to allow of but little space between it and the stem; that we may be the more certain that no pupæ of the winter-moth lie within the boot. But this is not much to be apprehended; for I have known of only two instances of the winter-moth coming out of the earth within the boot, and consequently very near the trunk.

At the end of October, it is time to bring this wooden boot into use, to guard the stem; and, consequently, the tops of the fruit-trees from the female moth. It must be smeared, as we have before said, in the angle under the coping with tar. If it is new, it must be smeared two or three days in succession, as at first the tar penetrates greatly into the wood, and soon dries. Afterwards, smearing is only necessary two or three times during autumn; and if the ground becomes frozen or covered with snow, it may be left off entirely. In spring, when the earth is thawed, the boot must again be daubed with tar, as some of the moths still come out of the earth, and once more in the beginning of May, in order that neither looper nor other caterpillars may come from other quarters, and reach the top of the tree; for the larvæ are as incapable of passing the tar as the wingless moths.

A boot of this sort is not very expensive, as it is not necessary to have the boards planed, and if not removed from the tree, it lasts several years; so that the expense for one tree amounts at most to about a penny a year. If the tar is reckoned at another penny, the whole preservative throughout the year costs only twopence for each tree. This trifling expense should not be grudged when we consider the damage which the green caterpillar does to fruit-trees. Besides, by this contrivance the orchard is protected for several years from these destructive caterpillars; for if they are once nearly extirpated, it is a long time before they again increase so much as to be very injurious. If it should be too expensive to many persons, to have all the fruit-trees in their orchard provided with wooden boots, let them only be applied to those trees which have a great show of blossom-buds in autumn, or to those they are anxious to protect from the green caterpillar. But these trees must be isolated, that is, not come in contact with the branches of those not so provided, that the caterpillars may not get upon them from other trees. He who avoids every expense for the preservation of his fruit-trees, and yet will by no means give them up to the attacks of the green caterpillar, must take a great deal more trouble to attain his end. He must go in pursuit of the female moth in autumn, and in spring of the caterpillar itself. The moths, as before observed, are numerous in the first days of November, and sometimes rather earlier in the evening than sunset. He must then examine closely every stem of his fruit-trees, with the assistance of a lantern, if it is dark, and kill the females as they are creeping up the stem.

This should be done every still evening in open weather in November, till ten o'clock at least. But as he cannot view all the trees at once, and while he is busy with one tree the females will find their way undisturbed to the top of another, he must be joined by assistants to make the pursuit effectual. An individual who persecutes the moths in this manner, will no doubt greatly contribute to lessen their numbers, meanwhile many females must escape, and lay their eggs on the fruit-trees. Therefore in spring the caterpillars themselves must be pursued.

Before the caterpillars have attained a certain size, it is very difficult to take them, indeed it is scarcely possible to do so on lofty trees; but rather easier on low ones. If we observe, on the latter, the points of the leaf or blossom-buds fastened together, so that their full expansion cannot easily take place, we have only (as previously observed) to separate the points with a penknife, and a small caterpillar will be found below. If we see one or two petals rolled in some degree together, and still fastened to the newly-formed fruit, we need scarcely doubt that a green caterpillar also lodges there.

When the caterpillars become larger, we are certain of seeing them on the dwarf trees, if we look for them between the leaves, or near the fruit. If we devote only half an hour every day throughout May to this purpose, we shall be enabled to save the leaves and fruit of many of our choice sorts of trees. As for the tall trees, we can only commence our operations on them when the caterpillars are half-grown, that is, in the beginning of May. They only now begin to be really voracious, and their ravages to be visible on the trees. There is no other remedy remaining but to shake the branches of the lofty trees violently, or, what is better, to strike them with a long stick, the point of which is enveloped in tow or linen, in order to throw down the caterpillars. When they fall on high grass, they are not easily found, and they crawl up again on the tree if it is unprotected. To prevent this, the grass must be mown very short. A large sheet placed under the tree will be of service. But in ploughed fields they are not easily overlooked, and therefore can readily be destroyed.

As the starlings feed their young almost entirely on the green caterpillars, little wooden cases are frequently fastened to the loftiest trees in spring, to attract the starlings, as they like to have their nests in places secure from birds of prey. For this purpose, boxes one foot and a quarter long and half a foot broad should be made of boards; having a stick or roost in the middle, and a round hole rather high on one side, large enough only to admit a starling, but not a larger bird. These boxes are to be fastened near the top of the main stem of tall trees, with the hole outwards. In districts where starlings are numerous, we may be certain that they will go in to these boxes in spring, and make their nests there. If there are several boxes in the gardens with starlings and their nests in them, there is no doubt that the fruit-trees, for the most part, will be cleared of caterpillars by those birds, and thus preserved from being stripped of their leaves.

We can effect but little towards destroying the winter moth while in the pupa state, as they lie in the ground, and are consequently invisible to us. As the caterpillars bury themselves for pupation sometimes near, and sometimes at a distance, from the tree, some of them will always be destroyed if the whole soil is cultivated with vegetables, and carefully turned over with the spade; and, if the tree is among grass, many pupæ will be destroyed if the earth is dug round the tree, both in summer and in autumn before the 1st of November, and every clod reduced to powder. But this proceeding cannot be expected to have much effect, if we do not attack the caterpillar and moth at the same time; and almost all these remedies may be dispensed with, if the fruit-trees are provided with the above-named wooden boot, as is sufficiently clear from what has been said *.

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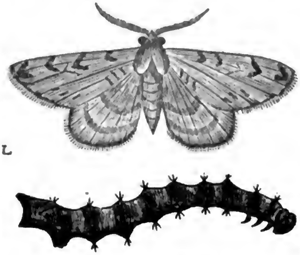
* I have found this green looper caterpillar feeding in the early spring upon the young buds of the apricot, in company with the larvæ of the narrow-winged red-barred tortrix (*Ditula angustiorana*, Stephens), I should conceive that the Baron Schmidberger has confounded two species together in his observations; the individuals which he states to make their appearance in the winged state in the spring are, I apprehend, a distinct species, namely, the *Cheimatobia rupicapraria*, Stephens, or *the early moth* of English collectors, a species very closely indeed allied to the *Ch. brumata*, and which feeds in the larva state on the wild plum.

Without objecting to the use of the wooden boot recommended by Schmidberger, I should consider that it would be equally efficacious to place a layer of bird-lime around the trunk of the tree, which would have the desired effect, and would not require daily renew-

The Pale Brindled Beauty Moth. *Geometra (Amphidasis) pilosaria*, Autor.

The pale brindled beauty, *Amphidasis pilosaria*, appears very early, often even as soon as the middle of March, on the fruit-trees; generally on pear-trees, as it is only occasionally met with on apple and other fruit-trees. The male is rather large; the fore-wings are greenish-grey, covered with a great number of fine somewhat brownish dots, and traversed by interrupted grey cross stripes, interspersed with whitish spots between. The hind wings are more or less white, and through the middle of them runs a brownish wavy cross-stripe. Before the fringes is another grey dark stripe. The body of the male is also greyish-green, beset with long hairs, particularly on the thorax. The female is without wings, small, coffee-brown, furnished with angular tufts of fine hair. The feet are long, and annulated with white and brown.



GEOMETRA PILOSARIA.

As soon as pairing is over, in March, the female seeks out a small side twig of the fruit-tree, scarcely as thick as the quill of a pen, on a high tree if possible, and deposits

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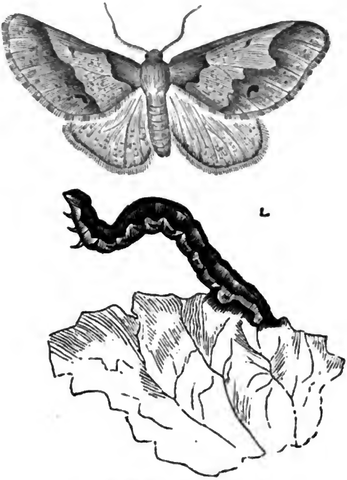
ing. Trees, however, trained against a wall would need other treatment, as the moths would have the instinct to creep up the wall, if they found themselves prevented in ascending the tree. They would indeed in all probability first attempt to ascend the stem, and being here prevented by the boot, they would mount the wall; but if bird-lime were employed, they would be caught by the bird-lime; whereas, if only the boot were used, they would not be prevented from descending, and then afterwards mounting the wall, and thus reaching the branches.

her eggs round it in the same manner as the lackey-moth, *Bombyx* (*Clisiocampa*) *neustria*, in rows downwards; and covers them with long grey hairs. From seven to ten eggs lie in each row, and more than twenty rows are in each ring. This ring is rather broader on one side than the other, and looks pointed. The female requires several days to deposit all her eggs.

As soon as the leaves begin to unfold on the twigs, the young caterpillars are hatched; they are light green, slightly darker on the first abdominal segment. Treitschke says that they are coffee-brown, with a double, fine, dark-brown line, down the back. This may be the case after moulting; as hitherto I have not been able to observe them after that period, for those which I saw hatched were either carried away by the ants, or driven away from the tree. This is the reason that but few of these caterpillars are found on fruit-trees; although more than a hundred eggs are contained in each ring. They generally do most mischief to lofty trees, as on dwarf trees they are not only liable to the attacks of the ants, which, as already observed, destroy great numbers, but they are more likely to be seen by the gardener when the trees are pruned. I have never seen a mole moth of this kind on a fruit-tree, and those which I possess I have found on the walls of buildings.—[Schmidberger.]

THE LIME LOOPER, OR MOTTLED UMBRE MOTH. *Fidonia* (*Geometra*) *defoliaria*, Autor. *Hybernia defoliaria*, Stephens.

The lime looper, or mottled umbre moth (*Geometra defoliaria*), takes its name from the lime-tree, on which it generally feeds; it also likes to visit fruit-trees, as I have found it almost every year on them, particularly on apple-trees. This caterpillar, when full-grown, is of a reddish colour, and has a brimstone-yellow stripe on each side, by which it is easily distinguished from other loopers. It goes into the earth about the end of May, and is transformed into a brownish-red pupa.



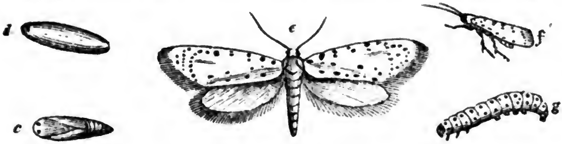
GEOMETRA DEFOLIARIA.

The moth comes out of the earth in the beginning of November, and seeks out a fruit-tree, like the green winter-moth, to lay her eggs on. The male is as large again as that of the winter-moth. Its broad fore-wings are of a reddish-yellow, covered with many blackish dots. From the anterior border, not far from the tips of the wings, a dark wavy line stretches across through these dots to the posterior border. Near to this line, almost in the middle of the wings, is a black dot. The under wings are dirty white, dotted with brown; and in the middle of the wings is a black dot. The female has no wings, is much larger than that of the winter-moth, and has no rudiments of wings. The head and body are whitish, covered with black streaks and dots, and the feet annulated with yellow and black.

This caterpillar is dangerous to fruit-trees in certain years when it appears in great numbers, as is sometimes the case. As a single female of this insect lays about two hundred eggs, the caterpillars of a few females are sufficient, if they all live, to strip a fruit-tree almost entirely of its leaves, particularly if it is a young one. It is not easy to take these caterpillars, because they live singly, and are scattered about on the fruit-trees; and it is not till they are nearly full-grown, and have partly stripped the tree, that they attract the eye. But the female moths are easily kept from the trees, when they are provided with the wooden boot, which I recommended to be put round the tree for the winter-moth. The female moths come out of the earth about the same time in autumn as those of the winter-moth; and as they are, like them, without wings, they consequently creep up to the top of the tree to deposit their eggs. They cannot therefore pass the boot smeared with tar, and remain sticking in it if they make the attempt. In this manner I have preserved the fruit-trees in the garden of the monastery for many years from looper caterpillars. Those who do not choose to make use of this preservative against this insect, must either go in pursuit of the moth every evening in November, or strike the branches of the trees with a long pole in May, to throw down the caterpillars, as I have recommended for the winter-moth. [Schmidberger.]

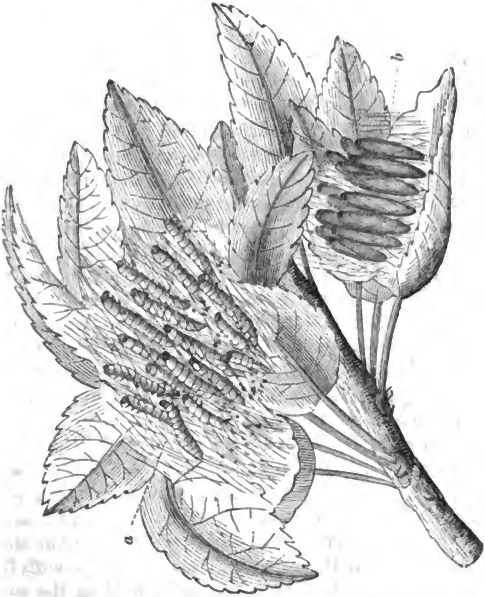
THE SMALL ERMINE MOTH. *Tinea* (*Yponomenta*) *padella*, Hüb. *Ypon. cognatella*, Tr.

In the same way as the larvæ of the saw-fly of the pear-tree (*Tenthredo hæmorrhoidalis*) encloses some of the twigs of that tree with an unsightly web, and eats off one leaf after another within it, so the caterpillar of the small ermine-moth proceeds with the shoots of the apple-trees, so as to be conspicuous at a distance. This moth (*Ypon. padella*) is a small nocturnal lepidopterous insect, scarcely five lines long;



YPONOMENTA PADELLA.

Caterpillar rather magnified *g*; perfect insect *f*; magnified *e*; cocoon *d*; chrysalis magnified *c*.



Caterpillars feeding *a*; cocoons within the web *b*.

the feet, antennæ, abdomen, and fore-wings, are white, the latter covered with about twenty black dots; the under-wings are blackish. The female lays from twenty to thirty eggs in a mass, at the end of June or beginning of July, near a blossom-bud, or in the absence of that, near a leaf-bud of an apple-tree. The caterpillars are hatched the same autumn, feed for a time, and enclose themselves in a joint web at the approach of winter, to preserve themselves from the cold. The following spring they are found in a mass together, either between the sepals of the calyx and the petals of the unfolding blossom-buds, or between two leaves of the leaf-buds.

As soon as the leaves of the apple-trees begin to be formed, these caterpillars take possession of them, selecting the tenderest parts for their food, but always living in society and under a joint web. When they have eaten the greater part of the leaves of a shoot, they draw threads over another shoot to secure it for food. Thus throughout May one shoot after another is covered with a web, and the greater part of the leaves devoured before the caterpillars have attained their maturity, which is generally about the middle of June. They are then from four to five lines long, dirty yellow, or lead colour, with a black head, and on the side of each abdominal segment is a longish black spot, and near it small black dots each furnished with a hair. As soon as the caterpillars are full-grown, they draw very near together in their common web, and each spins for itself a firm web, in which it changes into a brownish yellow pupa. In a few days the moth comes out, so that by the end of June many of them are found on the fruit-trees.

When these caterpillars are numerous on fruit-trees they do considerable mischief, as notwithstanding their diminutive size, they consume a great many leaves, and thus prevent the growth of the tree. They also deprive us of much of the fruit, as they never deviate from their course but attack whatever comes in their way, so that the twigs with fruit on them are robbed of their leaves, as well as the young shoots, which prevents the fruit from arriving at maturity and causes it to fall off before it is ripe. Besides this, the web is very unsightly, being defiled with the excrement of the caterpillars; therefore we must not suffer them to remain on apple-trees. It costs little trouble to remove them, as these insects always live together in society, and consequently may be taken from the tree by handfuls at a time*. A small Ichneumon fly materially assists us in diminishing them, by choosing the caterpillar or pupa to deposit her egg in; so that instead of the moth this fly comes out of the pupa. It is two and a half lines long, has a black head, thorax, and abdomen, with reddish antennæ and feet. I consider it to be Gravenhorst's *Ichneumon rubellus*. [Schmidberger.]

THE CODLING MOTH. *Tortrix* (*Carpocapsa*) *pomonana*, Autor.

Every amateur of fruit undoubtedly knows the small reddish white grub so often met with in early apples or pears, which appropriates a part of the flesh of these fruits to itself. This is the caterpillar of the Codling-moth, *Tortrix pomonana*.

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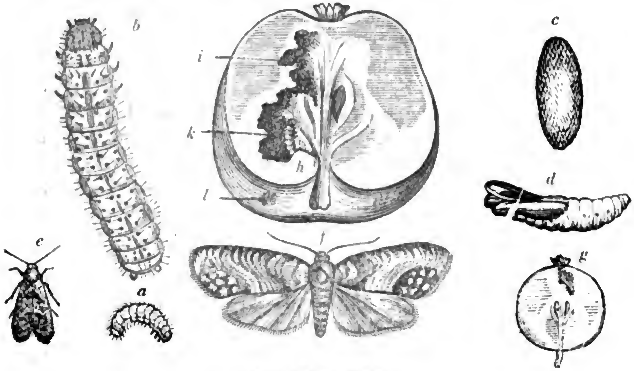
* In the *Gardener's Magazine* for October, 1837, I have given a more detailed account of the habits and injurious proceedings of the small ermine-moth, which especially in the north of France is occasionally so exceedingly numerous as to defoliate the apple-trees for miles. The observations of Schmidberger, however, furnish us with a fact which is at variance with what has been observed in this country, and which may I apprehend be explained by the warmer situation of Vienna from being so many more degrees to the south. Instead of the caterpillars making their appearance and commencing their attacks upon the leaves in the autumn, and then spinning themselves a winter retreat as detailed by Schmidberger, the larvæ of our English moth, although hatched in the autumn, do not quit the hard gummy covering formed by the female for the protection of her eggs until the following spring, when they at first burrow into the leaves, and it is not until they are larger that they unite to form the web which is so unsightly and detrimental. It is here especially partial to the hard cherry and the hawthorn, whole hedges of the latter being often entirely stripped of their leaves. In the work above referred to, I have detailed various plans for the destruction of this injurious insect.

The fore-wings of this small moth have a light grey ground, on which are scattered so many delicate streaks of a dark hue, intermixed with others that are broad and cup-shaped, as to give the whole some resemblance to damask. On the posterior border of the fore-wings is a large reddish brown spot, which is surrounded by a golden mark in the form of a horse-shoe. The hind-wings are of a sparkling brownish red inclining to yellow, and are surrounded on the outer border by a broad light fringe. The thorax and abdomen are of yellow-and-brownish grey.



CARPOCAPSA POMONANA.

Larva nat. size *a*; greatly magnified *b*; larva enclosed in a silk web *c*; chrysalis *d*; perfect insect *e*; magnified *f*; larva in a young apple *g*; larva feeding on the pulpy part of the apple *h*, *i*; larva *k*; quits the fruit at *l*.

This moth is to be seen in the evening, usually in the beginning of May, on the apple and pear trees busily engaged depositing its eggs, either on the calyx, or in the hollow part of the fruit at the stalk end. It appears to prefer apples to pears, at least more grubs are found in the former than the latter, when both sorts of fruit are plentiful. It invariably selects the firmer sorts of this fruit, knowing instinctively that they will be the most palatable to its future progeny. In favourable weather the little grubs are hatched in a few days, so that in May, apples and pears are found infested by them. At first the grub is white, with a black head and collar, and black slanting double dots, which run in four rows from the head to the abdomen. It afterwards becomes more of a flesh colour, the head and collar turning brown, the dots grey and indistinct. It is fully grown in three or four weeks, as its food never fails. It now leaves the fruit, whether it be still hanging on the tree, or has fallen off, and selects for itself a secure place on the stem of the tree to spin its cocoon and become a pupa. It usually chooses the rents and seams of the loose bark, hollows itself out a chamber and spins a white web over itself, intermixing some of the loose bark with it.

The little grub becomes a pupa immediately in the web, and in a few days the moth comes out, which shortly afterwards pairs and deposits eggs on the fruit. In this way in July and August, and partly in September, much sound fruit will again be pierced and infected with the caterpillar of this moth, which is then numerous in proportion to the number of eggs of the first generation which were laid and hatched in May. In the year 1822, which was warm and dry, more than the half, particularly of the choice fruit, was grub-eaten, and moths were still seen laying their eggs at the end of September. Fortunately those caterpillars which are so late in leaving the egg, seldom arrive at maturity, as the fruit is taken off the tree before that time.

To diminish this insect in some degree, we must, during the summer months and even later, collect the fallen apples every day, and take them out of the garden; for we shall find caterpillars or little grubs in a great many of them. Let the person who has only dwarf trees in his garden, frequently look over the fruit on them, particularly in May and the beginning of June, and remove those having grubs in them, as they would inevitably fall off before they were ripe, particularly if they are late sorts. This is more easily effected on trees in pots. A few moths may indeed fly from other gardens, but at all events they will be diminished by this plan. If all proprietors of gardens were to have all their grub-eaten fruit conveyed out of their gardens immediately, whether ripe or unripe, this remedy would prove to be effectual. And as this caterpillar, like the following one, usually forms its cocoon under the loose bark of fruit-trees, we are the more imperatively called upon to clear trees of this sort of their loose bark, which must be done, as we have said, before the middle of April, when the moths have not yet appeared. [Schmidberger.]

THE RED GRUB OF THE PLUM. *Tortrix* (*Carpocapsa*) *nigricana*, Schmidb.

The red plum caterpillar (*Tortrix nigricana*) is not so much to be dreaded as the copper weevil (*Rhynchites cupreus*) and the sawfly; but is, however, very injurious to the different sorts of plums, particularly the early and house plums, which are often rendered disgusting by the little red worm found in them. This worm does not produce a beetle, but a moth, not so large as a house-fly. Its fore-wings are black, changing to a metallic hue in the sun. On the outer edge of the fore-wings, and reaching tolerably far up, there is the appearance of very fine silver dust. The black spot on the extreme point of the fore-wings is surrounded with a white border, and has the appearance of an eye.

This moth appears in the beginning of June; but it is difficult to be distinguished on the plum-trees, on account of its dark colour. It is still more difficult to catch these insects, as they are easily frightened. Their eggs, which they lay on the plums, are hatched when the weather becomes warm. In July, the grub penetrates deeply into the plum, and the outward wound, which it made in entering, soon heals up. Richly fed, and protected from rain and wind, the little caterpillar arrives at maturity, while the plum continues to grow and ripen. Instead, however, of sweet pulp, the plum, when gathered, is found filled with the excrement of the caterpillar, which it never gives itself the trouble to endeavour to clean out, and the fruit generally falls off before the grub has left it. As soon as the caterpillar has attained its full size, it creeps out of the plum in search of a place to spin in, and when it meets with a loose or splintered piece of bark on a plum, or other adjacent tree, it insinuates itself between the bark and the wood, or penetrates as deeply as possible into the chinks of the former, where it encloses itself in a case before going into the pupa state. This takes place in spring, and the pupa is of a light brown colour. The moth generally comes out before the end of May, and immediately begins to propagate its species.

It appears, from the history of this insect, that but few means are in our power to diminish its numbers. Our first endeavour must be to get the plum-grub from the tree as soon as possible. If we see, for instance, that a plum begins to ripen before its usual time, we should shake the tree to make that plum fall, and immediately convey it out of the garden. The shaking of the tree must be continued several days; because there may be plums containing caterpillars that are not sufficiently ripe to fall at the first shaking, though these plums always appear to ripen much sooner than the others, as the severe wound which the plum has received brings on a premature ripening.

The fallen grub-eaten plums should all be picked up immediately, because the caterpillar does not remain long in the fruit lying on the ground, as it has in general attained its utmost size before the fruit falls. The plums, however, need not be thrown away, but may be distilled for brandy. Those who possess a great many orchards of plum-trees, will certainly find it worth while to pick out the grub-eaten plums from the rest, in order to destroy the grubs; and whenever there is an abundant crop, there are always a great many plums attacked by these caterpillars. It would contribute in some degree to lessen these insects if, in spring, the loose or split bark were taken off the trees, as the caterpillar is generally found lying under, or in it, as we have already mentioned; and after a good plum harvest, cocoons are always found in such situations. [Schmidberger.]

THE RED BUD CATERPILLAR. *Tortrix* (*Penthina*) *ocellana*, Tr. (*Pyralis luscana*, Fabr.)

There are many small caterpillars injurious to fruit-trees, which are more or less nourished by the blossoms, buds, or leaf-buds. The above-named red bud caterpillar belongs to this class.

The moth which proceeds from it is somewhat larger than the one above described, and so strikingly marked, that the one cannot easily be mistaken for the other. A white broad transverse band, studded with grey spots, extends through the middle of the fore-wings from one edge to the other, and occupies more than a third part of their whole surface; thus distinguishing this moth from every other. The other parts of the fore-wings are grey. This moth is found on fruit-trees towards the end of May. Its wings are closed, and lie slanting on its body. It is very timid, and can only be caught in cold rainy weather. Throughout the month of June it lays its eggs, singly, sometimes on the fruit-buds, and sometimes on the leaf-buds only, where they remain all winter, and only come to life the following spring. As soon as the sap is in motion, and the bud somewhat expanded, the little caterpillar creeps out of its hiding-place, and begins to gnaw the bud. A honey-drop is not unfrequently seen on the bud, which, issuing from the wound made by the insect, serves as a sign to assure us that the fate of the bud is decided, and that it will never expand farther. Should no sap, however, issue from the wound, the bud will continue to grow, and the little caterpillar with it.

The bud is prevented from growing, and from attaining its full size, by the honey-drop, the points of the calyx of the flower thus becoming so closely glued together, that their unfolding is necessarily prevented; and the caterpillar takes advantage of the opportunity to devour one blossom after another, until it arrives at its full size. Should the caterpillar come out rather later, when the buds are already unfolded, some of the blossoms are spared, and even some of the fruit. As soon, however, as the caterpillar finds a fruit near it, it immediately takes possession, and feeds upon it. It attains its full size in four or five weeks; it then spins itself a white cocoon, in which it changes to a light-brown pupa, and makes its appearance again in May as a moth. Although these caterpillars do no material injury to large trees, they are very unwelcome guests to dwarf trees, and trees in pots. When they come in great numbers, nearly all the buds on small trees are destroyed, and the crop, of course, can be but trifling. This little caterpillar is also a great annoyance to nurserymen; because, when it does not find any blossom-buds, it then attacks the leaf-buds, and unfortunately almost always selects the highest bud on the one or two years' graft for its storehouse; and thus, by the leading shoot being destroyed, the young tree is retarded, and disfigured in its growth.

In order to diminish the numbers of this insect, we must search for the caterpillar, as the moth is difficult to catch. As soon as the flower-buds begin to swell, the dwarf-trees, and trees in pots, should be often examined, and the caterpillar taken out with a penknife; with the point of which the leaf-bud, and the points of the calyx of the flower-bud, that are gummed together by the honey-drop, should be separated. If the caterpillar perceives that it is pursued, it conveys itself down as far as the embryo of the fruit; at first, only the closely adhering leaves of the buds should be separated, and allowed somewhat to expand; and when the small inner leaves become visible, the caterpillar can easily be taken out with the penknife. If we search for all the closely adhering leaf and flower-buds on our dwarf-trees, and trees in pots, during the blossoming season, and separate them, neither these, nor other bud-eating caterpillars, which are found on fruit-trees at the same time, will escape us. Sometimes we shall find a thick, dark-green caterpillar, with black spots, which is the *Tortrix cynosbana;* sometimes a light-green one, that is *Tortrix avellana;* sometimes the green caterpillar of the winter moth; and sometimes another green caterpillar, which is that of the *Tortrix fasciana.* If we continue to search for, and destroy the above-named caterpillars, we shall be continually doing good to the tree, as well as to the fruit. [Schmidberger.]

THE PLUM-TREE TORTRIX. *Tortrix (Carpocapsa) Wœberiana*, Autor.

Small conical heaps, of a red-brown powder, are often observed on almond, peach, apricot, and even plum-trees; under each of these heaps is a minute hole, leading to a furrow under the bark; in which a small larva is seen, which feeds on the inner bark of the above-named trees. These larvæ occasion the escape of the sap in the trees infested by them, from which a great many diseases arise; and which at last causes the total decay of the tree. The stems thus attacked suffer particularly from the exudation of gum, and various unnatural protuberances ensue. It must be of the utmost importance to gardeners, and friends of fruit-culture, to protect their peach and apricot-trees from so dangerous an enemy; or, if they are already attacked by these insects, to be able to get rid of them. A short detail of their history will be the most certain means of teaching gardeners how to lessen their numbers, and to destroy them.

TORTRIX WŒBERIANA.

This larva, when fully grown, is only three or four lines long, of a dirty-green colour, with a red head, and is the caterpillar of a small and very beautiful moth. It has three pairs of true feet, and five pairs of fleshy prolegs. The body is sprinkled with a few small hairs. The larva lurks, during nearly the whole year, under the bark of the trees, and the moth produces two generations in one year. The perfect insect appears first in the end of May, or beginning of June; and again in harvest. The female lays her eggs on the outer bark, from which the young caterpillars, by degrees, penetrate to the inner bark. A method must, therefore, be thought of to prevent the moth from laying her eggs on the tree, or to prevent the caterpillars from entering the inner bark. This may be effected by a solution of lime, with which the stem of the tree should be washed about the end of May, and again in September. It is also of great use to brush the tree with a hand-brush about this time of the year; as, by this means, the small eggs, not visible to the naked eye, are brushed away. Also those who set a particular value on their peaches and apricots can, if they have time, free their trees from these insects, if, as soon as they see the smallest heap of red dust, they introduce a needle, wire, or knife, into the opening, and destroy the larva.

It is very difficult to catch the moth; because it is very small, and can scarcely be distinguished from the bark of the peach and apricot-trees, on account of its brown colour. It sits with its wings folded in a slanting position. It is from five to six lines long. The fore wings are dark-brown and yellow; on the front edge are seen several silvery lines and yellow spots: there is a dark-brown stain on the upper part of the wings softened off at the edges, and surrounded by three red lines. The under hind wings are brown.

The pupa is brown, and lies also under the bark; and near the time of its becoming a moth it winds itself with a kind of screw-like motion to the entrance of the furrow, where half of its body projects outwardly.

The Copper-coloured Weevil. *Curculio* (*Rhynchites*) *cupreus*, Schönh.

Amongst those insects which feed on fruit is the copper-coloured weevil, *Curculio*, or *Rhynchites cupreus*. It is somewhat larger than the apple-weevil; and its horny wing-cases are furrowed and metallic copper coloured. Its body and feet are of a somewhat deeper shade, and its proboscis and antennæ are black.

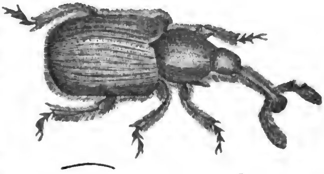
This weevil appears likewise in spring, indeed as soon as the tree puts out leaves, and is met with on different kinds of fruit-trees. Like the apple-weevil, it is very shy, and throws itself down as soon as any one approaches it. It is called the *Pflaumenbohrer* in Germany, or plum-borer; because the plum is selected for the reception of its eggs, and for the nourishment of the little larvæ proceeding from them. In default of plums, they make use of the soft spring shoots of the plum and apricot-trees. This is the second insect that is injurious to the plum-harvest. When the plums have nearly attained the size of large almonds, the female weevil selects one in which to deposit her egg. As the larva can only be transformed into a beetle when buried in the earth, and as, when buried in the plum, it cannot come down of itself from the tree, the parent-beetle obviates the difficulty by cutting through the stalk of the plum with her proboscis as soon as she has deposited her egg. As if the operation of separating the plum from the tree were, however, too great a fatigue to be accomplished at once, she divides the labour, and first cuts the stalk only about half through, leaving the other half to be divided after the egg is laid. To effect this, she holds herself firmly on the stalk of the plum, and with the hind part of her body turned towards the fruit downwards, she begins sawing through the stem till she reaches about the middle. She then gets on the plum, and, fixing her abdomen on the stem, begins cutting with her proboscis the epidermis of the fruit into arched cuts; she then raises up the skin, bores a hole beneath it in the pulp, and forms a roomy chamber for her offspring. When this is accomplished, she lays her egg at the entrance of this apartment, and pushes it in with her proboscis. She then turns the epidermis down, closing the entrance with it so effectually, that not the smallest drop of water can reach the egg. She now cuts the stem completely through, and getting up at last on the part which remains attached to the tree, by her weight causes the plum to drop off. Sometimes she cuts through the stem only partially, and leaves the plum to be broken off by the wind and weather. Laying the egg, and cutting through the stem, occupies the female from two to three hours, from which it may be understood, that but few eggs are deposited in the course of one day, and the more so, as but one egg is intrusted to each plum. The egg does not remain long dormant in the plum on the ground; for, if the weather be favourable, the larva is hatched in the course of a few days, and, as the plum is destined for its food, it proceeds to penetrate into, and to consume the pulp; its apartment becoming larger as it increases in size; because the more of the plum it devours, the larger its chamber of course will be. If the weather be favourable, the larva will have consumed the interior of the plum in five or six weeks; and, having attained its full size, it will be ready for its final change. It then buries itself in the earth, where it forms itself a new dwelling, and where it awaits its transformation. This takes place in the following spring, when it appears as a beetle, and again begins the work of regeneration.

The egg and the grub hatched from it have always some dangers to encounter, which often prevent the insect from undergoing its other changes. For instance, if the plum containing the egg fall on the bare earth, and dry warm weather set in, the half-grown plum shrivels and with it the egg; and should the grub actually be hatched, it must be starved to death, its proper food being wanting. Should continued wet weather set in, when a grub is already hatched, it perishes for want of food in this case also, because the plum soon becomes rotten and unfit for its use.

The great injury which the copper-weevil is in some seasons capable of doing to the cultivation of fruit was seen in 1821, when several plum-trees were entirely stripped of their fruit by it; because if left undisturbed, it never leaves the tree until it has pierced and thrown down every plum that it can find. It is very difficult to catch these beetles on the tree, but much easier to destroy their young. The plums thrown down by the beetles should be carefully picked up and destroyed, on account of the young grubs contained in them. This collection need not be made every day; because, as we have already said, a few weeks are necessary to accomplish the hatching and maturity of the grub; but it should be done, and it is unnecessary to state how much this operation tends to secure a good plum harvest the following year. The next easiest method of securing the plum crop, at least for the time being, is to shake the trees frequently in the course of the day, because by a strong movement of the branches, the apple-weevil, which is also often found upon the trees, may in the same manner be thrown down. As these weevils are generally occupied in laying their eggs from the latter days of June to the end of July, the shaking ought to take place during that time. As the copper-weevil is not numerous every year, and as several years sometimes pass away without its becoming dangerous to the plum crop, the shaking ought to take place in those years when, from the plums already fallen, it can be ascertained that the insects are becoming troublesome. However strong the wind may be, it very seldom throws down healthy half-grown plums. [Schmidberger.]

THE BACCHUS OR PURPLE APPLE WEEVIL. *Curculio (Rhynchites) Bacchus.* Schönh.

It was formerly thought that the codling or pear moth was the only one injurious to the apple; because it laid its eggs on it, for its young to feed upon the flesh; but there is also a beetle which selects the apple for the abode and nourishment of its offspring. This is the Bacchus Weevil (Rhynchites Bacchus).



CURCULIO BACCHUS.

This beetle is of a purple and gold colour, with its proboscis, antennæ, and tarsi, of a dark blue. It is nearly the size of the already described Rhynchites Betuleti, which is injurious to the vine, yet being variable in size, there are many individuals larger, and many smaller than it; though its proboscis is much longer and stronger than any of the others, and this, together with its colour, decidedly distinguishes it from R. Betuleti. It was formerly considered by the pomologist as the true vines weevil (R. Betuleti), and therefore had the name Bacchus bestowed upon it. Since I have made pomology my study I have never found it on the vine, but the apple is its favourite food. Therefore I consider myself justified in not calling it the vine weevil, but the purple apple-weevil. It is found early in spring on the fruit-trees, and only begins the work of regeneration about midsummer. To effect this, it selects the smooth side of the apple, bores a hole in it with its proboscis, and proceeds to form a roomy chamber in the heart of the fruit. It then lays an egg at the entrance, pushes it in with its proboscis, and closes the opening; at the same time arranging the epidermis partly with its proboscis, and partly with the extremity of its body, so as to cover the hole, of which by means of a glutinous moisture which issues from its mouth, it finishes securing the entrance. This operation is no sooner over, than it bores a second hole near this chamber in which to deposit another egg. It sometimes happens that it deposits three or four eggs in one apple, before it leaves it for another.

The grub, which is whitish, with a black head, is hatched from the egg in the course of a few days, and immediately begins to eat the food that is so near it, making its apartment larger by eating deeper into the apple. It generally advances as far as the core, and like the caterpillar of the codling moth it makes itself a passage to the surface of the apple, probably to throw out its excrement, or to admit more air. The larva attains its full size in three or four weeks, and resembles the caterpillar of the codling moth, but is not so much of a flesh-colour, although about the same size*.

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* Like the larva of all the weevils, it is destitute of feet, by which means it is at once distinguished from the larva of the codling moth.

It leaves the apple when it is ready for transformation, and conceals itself in the earth, from which, in the following spring, it reappears as the Bacchus weevil.

Fortunately for our apple crop these beetles are seldom numerous; in the year 1823, however, they were found in great numbers on the apple-trees, and particularly on trees in pots, and therefore a great many fine eating apples were destroyed.

To lessen the number of these beetles, no other method can be advised but that of picking up the injured pierced apples, and conveying them out of the garden. As it is particularly injurious to trees in pots, and can destroy the fruit in a few days, the gardener must be on the alert, and as soon as he sees them on his apple-trees in pots in the months of June and July, he should shake the trees well early every morning during these months, in order to throw down the beetles and kill them; because they conceal themselves under the leaves during the night. This shaking of the trees is also to be recommended at that time on account of the codling moth which is so injurious; and which is easily thrown down early in the morning, as it is then somewhat stiff with cold, and can be more readily killed. [Schmidberger.]

THE STEM-BORING WEEVIL. *Curculio* (*Rhynchites*) *Alliariæ*, Fabr.

This is a small beetle, scarcely a line broad, and one and a-half long, which does great injury to the gardener, and particularly to the nurseryman; because it mangles the shoots of the young trees, and the finest grafts. It is the *Rhynchites Alliariæ* of Fabricius, and is a small weevil, entirely of a steel-blue, or a steel-green, shining, metallic colour.

As soon as the blossom and leaf-buds begin to unfold, the beetle appears, and flies, during its usual time of pairing, from one tree to another. When the shoot of the tree, or graft, is about a span long, the female selects one that suits her, and it does not signify to what kind of fruit-tree it may belong. As soon as she has reached the most suitable part of the shoot, she marks the place first by a prick, or by a small cut, where she intends to cut off the bud, or shoot. She then recedes about a line upwards, and begins (with her head turned downwards), on the side that is not next the tree, to bore with her proboscis till she reaches the middle of the shoot. With it she also widens the chamber, and prepares it for her offspring. She then places herself over the entrance, and lays an egg, which is pushed in by the proboscis, and conveyed to the proper place. This operation lasts an hour. Immediately after, the female returns to the former place, to cut off the shoot, moving it from one side to the other with her proboscis, until she has cut it a certain depth. She then gives some decided thrusts, which she continues, without fatigue, till the shoot only hangs by the under part. When she observes this, she gets up on the point of the twig, to make it fall over by her own weight. It not unfrequently happens that it falls immediately, the shoot having been previously so cut, as to remain attached to the stem only by the bark. If the beetle, however, finds that the pierced shoot does not fall, she turns back to labour again at the same place, and cuts still deeper through the branch ; and if she is not able to divide it, she gets up once more to the farthest extremity, by which means she generally succeeds in bringing the separated branch to the ground. When this labour is over, she feeds upon a leaf, scraping off the epidermis, which serves her as food.

After the beetle has rested about an hour, she goes again to work ; and if there be still a place for the reception of a second egg on the pierced shoot that she has divided from the stem, she bores a second hole with her proboscis near the first, and laying another egg, pushes it into its proper place. When the twilight comes on, she reposes under a somewhat bent leaf for the night. Next morning, as soon as the sun is up, the female beetle again begins her day's work, and often continues this employment until after the end of June, so as by this means to leave a numerous offspring behind her. The preparation of the chamber, the depositing the egg, and particularly the cutting off the shoot, occupy her a considerable length of time; and, however industrious she may be, she can only cut off two shoots in one day, and deposit two eggs in each shoot. Wet weather, however, and strong winds, often retard her operations for whole days, so that the number of eggs a female can lay cannot be great. The shoots which she has been unable fully to detach, and which are left hanging to the stem, are generally left to chance, sometimes they fall off, and sometimes they remain on the tree till they are completely withered up. The egg in the shoot is hatched in the course of eight days, and a white grub, with a black head, then makes its appearance. It feeds on the pith of the shoot, and if the shoot falls off, it arrives at its full size in four weeks. It then leaves its dwelling, and buries itself some inches deep in the earth. It there prepares itself a roomy chamber, in which it remains till the spring, when it again appears as a steel-blue coloured weevil. When the tree begins to sprout, it comes out of the ground, gets on the tree, and propagates its species. It will be seen, in the first place, from the foregoing account, that the shoot in which the female has laid her egg must fall to the ground, in order that a new weevil may be produced, because its transformation takes place in the earth: secondly, it is evident that the egg, and even the larva, must necessarily perish, if the shoot lies on the bare earth exposed to the sun's rays for a long time; as in this case the shoot quickly shrinks up, the chamber is narrowed, and the egg, of course, crushed. Even if the worm should be developed, it will be unable to find its proper nourishment in the withered pith, and must, therefore, be starved to death. It is thus clear that it is only when the shoot lies in the grass, or in a shady place, that the worm attains its full size; because the pith of the shoot is not so withered up in such a spot: and, thirdly, that a dry May and June are very unfavourable to these beetles; but when these months are wet, they are favourable to them.

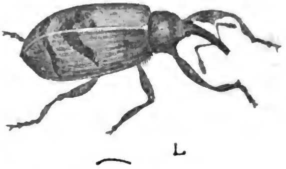
From the natural history of these beetles, the method of diminishing their numbers is to be sought. The full-grown insect must, above all things, be looked for, and it is easily taken at the time of pairing. If we look for these beetles in spring, their splendid steel-blue colour immediately attracts the eye. When they sit on buds, or leaves, we must approach them very cautiously; and while we try to catch them with one hand, we should put the other under the shoot, or leaf, because they easily throw themselves down when they perceive the approach of danger. If we had not made a very thorough search for them in 1829, we should have had but few grafts remaining in the nursery. As we cannot, however, remove the whole of them, we should collect all the shoots that are lying on the ground, and also those which are still hanging on the tree, that have been attacked by this beetle, and destroy them; because, as we have shown, the eggs are deposited there. Let us, therefore, not be remiss in this particular, by which means the beetle will not be very injurious.

There are many of these kinds of beetles about half the size of the one mentioned, which do not lay their eggs in the pith of the shoot, but in the pith of the petiole, and exactly in the place where it is joined to the leaf. Instead of cutting off the petiole, the female punctures it to the right and left of the part where her egg is deposited, which soon causes it and the leaf to wither and fall off; the grub then, as we have stated, takes up its abode in the earth, and changes to a beetle. A leaf thus attacked may easily be known by its rumpling up where it was punctured, and by its becoming withered; therefore to put a check to the multiplying of these insects, these leaves ought to be taken off and destroyed as soon as perceived. [Schmidberger.]

THE APPLE WEEVIL. *Curculio* (*Anthonomus*) *pomorum*, Fabr.

Among those insects which are destructive to the blossom of fruit trees only, belongs the above mentioned apple weevil, *Curculio* (*Anthonomus*) *pomorum*. It is often thi insect alone which destroys our apple crop.

It is a small beetle, as without reckoning the proboscis, it scarcely measures one line and a half long. Its wing-cases are of a dark brown colour, with whitish grey stripes, its rostrum (in the middle of which are the antennæ), its eyes, and the under part of the abdomen are black.



ANTHONOMUS POMORUM.

As soon as the sap is in motion in the trees in spring, this beetle makes its appearance, and immediately searches out an apple-tree, to pair on its buds. It gives the preference to the apple blossom, and only makes use of the pear blossom when the apple blossom is not to be had. It remains all the winter under clods of earth, stones, or fallen leaves, or in the chinks of the bark of different kinds of trees. When the blossom-buds are pretty full of sap, the beetles begin to deposit their eggs, and according as the warm spring weather sets in early or late, the grubs are hatched in the first or last days of April.

As it is not every blossom-bud that is fit for the reception of the egg, the female insect is seen hastening from one branch to another, examining every bud carefully, and often taking a long while before it can find one suitable for its purpose. When it finds a particularly good blossom-bud, and has selected the spot where the egg is to be deposited, it bores a hole with its proboscis, till it reaches the parts of fructification. Here in the centre of the blossom, the space is enlarged by means of the proboscis, and formed into a roomy chamber for its offspring. The female then fixes herself at the entrance, and having laid an egg, (only one in each hole), she pushes it in with her proboscis. After the completion of this work, which lasts about three quarters of an hour, she bores a second hole near the former one, in the centre of another blossom of the same bud; (each bud containing from five to seven single blossoms;) or she looks out for another blossom-bud. The female beetle generally walks from one bud to another; nor are these insects often seen flying from branch to branch: they are only busy laying eggs on calm days; during windy frosty weather, they again conceal themselves, so that it is not easy to find them.

As soon the blossom-buds begin to unfold, the deposition of the eggs has been completed, and although the beetle may still insert an egg, the object of propagation is at an end, as we shall see presently. The quicker, therefore, the complete unfolding of the flower-buds takes place, the shorter the time in which the beetles lay their eggs will be. In the year 1817, the sap did not begin to flow in the apple-trees till the end of April, and on the 16th of May they were in full flower. So quickly was the unfolding of the flower-buds accomplished, that the weevil could only perform the work of oviposition during ten days; because on the 9th of May I did not see a single one on the apple-trees. Accordingly, the blossoms that season were very beautiful. In the year 1816, on the contrary, the blossom-buds were attacked by these insects for nearly three weeks; because the cold, fog, and rain, checked the progress of the sap already in motion, and therefore the buds which were already swollen out, were for several days prevented from unfolding; and scarcely a blossom was to be found that was not pierced. No wonder that there was no apple crop that year.

It is uncertain how many eggs a female of the apple weevil lays; but that the number is considerable, may be concluded from the greater proportion of the blossoms being pierced in those years that are favourable for this weevil, although there are always but few individuals found on the trees.

The warmer the weather is, the sooner the egg is hatched; the grub or larva often comes out on the fifth or sixth day. It immediately then attacks the parts of fructification, that is, the innermost parts of the blossoms, and devours them one after another. In the meantime, the blossom-bud continues to swell, and the petals to open, till it is almost expanded. All at once, however, its growth ceases, because not merely the blossom, that is, the stamens and pistils of the flower, but the receptacle itself on which they stand, is devoured. The petals therefore, which remain partially closed, forming a kind of cap, wither by degrees, and at last assume a scorched appearance. If one of these flower-caps is opened, when it first appears, a small white grub with a black head, will be found in it on the embryo, which by degrees becomes yellowish. If the flower be opened a few days later, the little grub will be found either wholly or partly changed into a beetle, without having previously surrounded itself with a cocoon. If a small hole is seen on the side of the cap, it is a sign that the beetle has already left its dwelling, because the complete transformation of this insect from the egg to the beetle is accomplished within four weeks.

It is only in a dwelling well protected and secluded, that the little grub can undergo its changes, and become a beetle, because rain and sunshine are alike hurtful to it, and kill it when it is exposed to their immediate influence. If, therefore, the petals should be expanded before the grub is hatched, it will be destroyed, because it has no covering; and this is also the case with those grubs that take up their abode in blossoms which are open at the side. If the grub die before all the parts of fructification are destroyed, particularly the pistils, the fruit may set; but should they be eaten away, which is always the case before the insect's transformation is accomplished, there is no hope of the fruit.

When the beetles leave their dwellings, they disperse on all sides, so that they are seldom to be seen; and they remain throughout the summer on the fruit trees, where they feed on the leaves. They are always very shy, and precipitate themselves to the ground as soon as they are approached; they search out lurking holes in autumn, in which they spend the winter.

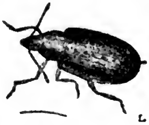
As the history of these insects shows, it will not be easy to discover an efficacious remedy to protect fruit-trees from their ravages, but there are many methods at present in use, which in some degree lessen their numbers. It is not possible to catch the beetle on trees with lofty trunks; this, however, can be done on dwarf-trees, or on those with drooping branches, and also in spring at the time of pairing, or later when the female insects are piercing the bud. They are particularly easy to catch during the last mentioned operation, as they are too much occupied with it to be aware of the hand that is extended to seize them. I have hitherto always saved the greater part of our apple crop on dwarf trees in this manner, when the blossom was in danger of being destroyed by the beetles in years that were favourable to them.

If the flower-buds have already made their appearance, and cool foggy weather has set in, by which the sap is arrested in its course, the weevil, as has been observed, gains more time to attack the blossoms, and the already hatched grub in like manner consumes more of the parts of the flower, and prevents its unfolding. The apple-trees are therefore in great danger, during such weather, of having their fruit destroyed. No other remedy remains but to shake the trees with energy several times a day, to throw the beetles to the ground. They will indeed re-ascend the tree nearest them, in order to attain their object; but until they get themselves settled, so as to reach the flower-buds, a considerable time passes away, perhaps one or two hours, and this is sufficient to be of considerable advantage to the tree, because at least a part of its blossoms will be saved.

In order to lessen the number of the apple weevils, it is advisable that loose stones and leaves which may have fallen late in autumn should be removed from the garden and not left till spring. The loose or broken bark of the fruit-trees should also be cleared away, as the apple weevil usually conceals itself throughout the winter in such places. An effectual remedy against the multiplying of the insect consists indeed in taking the pierced blossoms from the fruit-trees, at the time when the flower-cap begins to be formed, and before it has assumed its burnt appearance; because at that time the larva or grub has not become a beetle, and consequently still remains in the blossom. But who would give himself so much trouble, and what a time it would require to collect these blossoms from a lofty tree! This is easily accomplished, however, on dwarf trees, as they can be stripped of these grubs in a few minutes. If there are only dwarf trees in the garden, and particularly if there are no tall apple trees near them, the garden will, for several years, be freed from this insect, or at least its numbers will be rendered of no importance, by picking off the pierced buds. As this beetle, in default of apple-blossoms, attacks the pear blossoms, we should have an attentive eye on the dwarf pear-trees, and free them also from the pierced blossoms. [Schmidberger.]

THE PEAR WEEVIL. *Curculio (Anthonomus) Pyri,* Kollar.

As the Apple Weevil sometimes considerably lessens the apple crop, a similar destruction is effected with the pear crop, by the nearly allied pear weevil. Both insects are so much alike in their perfect state, that the one can scarcely be distinguished from the other; in the larva state, on the contrary, they differ decidedly from each other both in their form and mode of living. While the apple weevil contents itself with only single blossoms of the apple-trees, for the abode of its offspring, the pear weevil attacks all the blossoms, and even blossom-buds and leaf-buds together. If a pear-tree is examined at the time of blossoming, it will be seen that many buds are brown at the points, as if affected by the hoar frost. If these buds are examined closely, there will be found a dirty white rugose maggot, with a dark brown head, which in time is changed to a small weevil. It is scarcely



CURCULIO PYRI.

more than three lines long, brown with a white uneven band, almost in the middle of the elytra, and two black shoulder-spots, therefore perfectly like the apple weevil. This insect probably passes the winter under the bark, or in the earth near the stem. Early in spring, when the pear-tree begins to bud forth, the female lays her eggs in the buds, which causes them to become brown by degrees, and to fall off when the insect has attained its perfect state. If this insect does not exceed its due limits it may be considered more as a benefactor than as an enemy to the pear-trees, which very often suffer under a weight of fruit, and from too great a distribution of the nourishing sap, produce a crop of inferior quality. Should the attacks of these weevils on the pear-trees become too numerous, their number must be lessened for the next year, by taking off the pierced buds; which must of course be burnt in order to destroy the larva within.

The number of these insects can also be lessened by shaking the trees early in spring; and a white cloth should be spread under the trees so that the fallen insects may be seen. Strips of paper covered with tar should also be bound round the stems to prevent the beetles from ascending. It is to be understood that all these methods can only be applied usefully on low trees in small gardens.

THE OBLONG WEEVIL. *Curculio* (*Polydrusus*) *oblongus*, Fabr. *Nemoicus oblongus.* Stephens.

It is not only the cock-chaffer which deprives our fruit-trees of their leaves, but there are several small beetles, which occasion great damage in this respect. One of the most numerous and most dangerous amongst these, is the above named oblong weevil, *Curculio*, (or *Nemoicus*) *oblongus.*

This beetle is included among the weevils, although it has a very short rostrum. It is small, only two lines long, and something more than a line broad. Its head, thorax, and body are black, its antennæ and feet reddish, and its elytra furrowed, and reddish brown or blackish. It makes its appearance very early in spring, and is seen on the leaves when it has scarcely completed its development. It particularly prefers young trees, to which it is very destructive. No kind of fruit tree is secure from its gluttony; the leaves of the pear, apple, plum, and apricot, and particularly those of the peach it considers delicious food. It generally selects only the best part of the leaf, and leaves the midrib and the petiole.

These beetles were very numerous in the gardens in 1831; and we could scarcely preserve the budded peaches from them, so much were they exposed to their attacks. This alarm for the peach-trees, lasted nearly all the month of May; and when we had apparently removed them all one day, new ones were found again the next.

Pairing follows in spring, which, judging from the couple I saw, is repeated several times. In June, the female enters the earth to deposit her eggs there; and the grub that is produced from the egg, feeds on the roots of different kinds of plants, passes the winter in the earth, and appears again, transformed into a beetle in spring.

As these insects, if numerous, would be very injurious to young trees, we ought to watch them carefully in spring, particularly in May, and to take them away wherever we find them. As they are not so shy as the other weevils, and allow themselves to be caught by the hand, if we are only a little cautious, their destruction may be easily accomplished.* [Schmidberger.]

THE RED-FOOTED BEETLE. *Luperus rufipes.* Fabr.

There is still another small beetle, which selects the leaves of fruit-trees for food; and this is what the Germans call the red-footed beetle, *Luperus rufipes.*

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* I have received specimens of this insect from Mr. John Wighton of Cossey, who states that they are very destructive to the leaves of trees in June, being sometimes found on the vines in the gardens of Lord Stafford. In the habit of the larva feeding under ground this insect agrees with the *Otiorhynchus sulcatus* described by me in the Gardener's Magazine, No. 85, and of which additional notices are also contained in some of the subsequent numbers of the same work. The last named species is not mentioned by Schmidberger.

This beetle is somewhat smaller than the oblong weevil, of a shining black throughout, except the feet, which are red. The tips of the antennæ are black, and the basal part reddish. It appears generally in May, and is often so numerous that the leaves are almost completely covered with it. Moreover it does not eat off the whole leaf, but pierces holes through it, like the *Anisoplia horticola.* These insects remain a tolerably long time on fruit-trees, being seen on them the greater part of the summer. As they prefer the apple-trees to all others, and particularly newly-planted and young dwarf-trees, they are very injurious to them when numerous. This small beetle ought upon no account to be suffered to remain on the fruit-trees, as it is so easily caught and destroyed. It lays its eggs in the ground, from which, in the following spring, the beetles are again produced. [Schmidberger.]

THE GARDEN BEETLE. *Melolontha* (*Anisoplia*) *horticola*, Fabr. *Phyllopertha horticola.* Kirby, Stephens.

The *Melolontha* (or *Anisoplia*) *horticola* is another leaf-eating beetle. It is considerably larger than the oblong weevil, measuring four lines and a half long, and nearly three broad. Its wing-cases are of a red-brown, but somewhat shining, and not reaching to the extreme point of the body. Its body, thorax, and head are dark green, its antennæ reddish, with a dark green strongly-cleft terminal club.

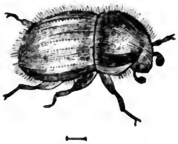
ANISOPLIA HORTICOLA.

This beetle appears somewhat later than the one just mentioned, and also feeds on the leaves of different kinds of fruit-trees. It is particularly injurious to the apples; because it feeds on them when they have hardly attained the size of a hazel-nut. Besides, these beetles are not fastidious, for they attack the leaves of both kernel and stone-fruit. Sometimes they appear in great numbers, when they do serious injury to the young fruit-trees, often gnawing all the leaves till they resemble a sieve, and thus checking the growth of the tree, and causing its fruit to fall. They are seen during a great part of the summer on the fruit-trees, and after pairing, the female retires to the earth to lay her eggs there. The larvæ when hatched feed on the roots of plants, are transformed to beetles, and appear again as such in spring.

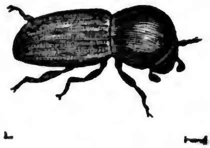
If these beetles should appear in great numbers, they ought not to be neglected. As they are tolerably large, they are easily seen, and can be removed without difficulty. As they like to be on the dwarf apple-trees on account of the fruit, we must often attend to them, and free the trees from such dangerous guests. [Schmidberger.]

THE APPLE BARK-BEETLE. *Bostrichus dispar.* Autor. (*Apate dispar*, Fabr.) *Xyloterus dispar.* Erichson.

It is well known that several years often pass away before an injurious insect multiplies so much as again to become troublesome. Some insects, however, appear so seldom, that they are completely forgotten, and indeed cannot well be reckoned amongst those that are injurious. No one, for instance, knew the *Tipula Cerealis*, or *Musca Frit*, the barley or wheat devastator, which in 1816 and 1817 occasioned so great a devastation in the barley and wheat fields in the neighbourhood of Ens in Austria. The oldest people could not remember ever having observed traces of this insect in the corn-fields, and since the year 1817 nothing more has been heard of it. This is also the case with the apple-bark beetle, which attacked my trees in pots in 1834, and killed several of them. As far as I can



MALE.



FEMALE.

APATE DISPAR.

remember, I only once found one on a dwarf apple-tree, but no more during several years. I cannot say where this beetle came from, but probably from the neighbouring wood, although, as we shall see, this beetle does not belong to those that are known to be injurious to the forests. Some pomologists speak in their writings of the injury done by the bark-beetle to orchards, but only in general terms, and in so undecided a manner that nothing can be learned from what they say, neither can we ascertain which kind of bark-beetle it is that attacks the fruit trees. I have therefore undertaken to make known the economy of this new visitor which I found injurious to my trees in pots, as far as I can get information on the subject.

The bark beetle which destroyed my trees is the *Bostrichus dispar*; and I call it the apple bark-beetle, because it prefers the apple tree to all other fruit-trees in the garden for depositing its eggs. It is called *dispar* (unlike), because the male is not only about half the size smaller, but is also very differently formed from the female, bearing more resemblance to the bracken-clock (*Anisoplia horticola*) than to the bark-beetles in general; it is of the same colour as the female. This kind of beetle is one of the small bark-beetles, being only one line and a quarter long, and half a line thick. The head and thorax are black, the extremity of the palpi and antennæ, reddish, the longish wing-cases blackish, and somewhat hairy, the feet dilated and of a reddish yellow, the thighs black. The female resembles the long-haired bark beetle, *Bostrichus villosus*, yet its wing-cases are not deeply furrowed and the spots not so deep as they are in that species. The male is also somewhat smaller than the female, and it has chestnut-brown wing-cases, and reddish thighs.

On the 3d of May I found the first beetle of this species on an apple-tree in a pot, where it had begun to bore into the trunk of the tree. The sap which flowed from the wounded part, caught my attention, and betrayed the beetle. As only the hinder part of the insect was to be seen, I cut round the place, and having extracted the beetle, stopped up the wound with bees-wax of the kind used in grafting, in order by that means to save the tree. But it was too late; the sap made itself an outlet between the bark and the bees-wax, and continued to flow, notwithstanding my having several times pressed in the wax; and the tree began to wither. The next day I found several beetles in the act of boring, only a few of which I could destroy, without making an incision in the bark. Where they had only bitten the bark, and none or but little sap flowed out of the wound, the tree was saved by the removal of the beetles. Those trees, however, where the sap freely flowed from the wound were destroyed, although the beetle was taken out; and this was particularly the case when the stem had been bored by several beetles.

In this manner twenty-two of my trees in pots were destroyed. Forty-two were bored, and most of them by several beetles. Not a single pear-tree was attacked; I only found one plum-tree which was bored by them, although more than thirty grew near to each other; and this tree died in a few days. They also did not attack single dwarf-apple-trees standing in the border; although there were a great many growing there which were much lower than the trees in pots, which were arranged on a low wall. The latter trees must have been exactly high enough for their flight, to have been chosen for a breeding place.

Soon after their arrival they look out for a place in the tree, in which to lay their eggs, usually on the principal stem, below a branch, or in the branch itself, and indeed near its point of junction with the tree. Sometimes their eggs are laid on the half-healed wound of a lopped twig, or in the middle of the stem, but never near the earth. The insect makes no distinction between the age or healthy state of the tree, whether it is old or young, or whether it may shoot out much or little; so that it has a tolerable thickness (at least half an inch in diameter) it is found suitable for the purpose. No tree was previously sickly, because all the causes of disease had been removed in the previous autumn.

When the female finds a suitable place she bores a completely round but somewhat oblique hole in the tree, and penetrates to the centre or at least near it; she goes first upwards to the side, and then downwards. When she comes near the bark she turns back, and goes to the other side, or downwards, forming a new path. The paths leading upwards and downwards are sometimes long, and sometimes short, but seldom exceeding one inch and a half in length. The minute particles of wood, or worm-meal, as it is called, are thrown out, and serve as a sign of the presence of the insect. Bechstein says, speaking of the pine-beetle, *Bostrichus typographus* and *piniperda*, that it is the larvæ themselves which eject this worm-meal so abundantly; but in the case of the bark-beetle here treated of, the worm-meal which I found outside of the entrance always proceeded from the beetle itself, as will appear from what follows.

At the end of the entrance, the female makes a somewhat wide apartment, and lays her eggs in it in a heap; they are of a snow-white, longish, and of a somewhat posteriorly pointed form, from seven to ten in number, and sometimes fewer. The path, however, is previously pretty thickly covered with a whitish substance, which resembles an incrustation of salt. I consider this as a kind of Ambrosia, on which the hatched larvæ feed, and I conclude it is their principal nourishment, as I saw no passage or chamber in which the eggs were laid, without this substance, and no full-grown larva in the passages and chambers in which this substance was not consumed. As it has been stated it is whitish, easily rubbed with the finger to the finest powder, melts on the tongue, and is without any particular taste. I am of opinion that the female forms this substance from the sap of the tree, to which she adds a peculiar juice; to effect this object, as may be seen, no tree that is already withered will do, but one that is healthy and full of sap is necessary for the purpose.

At the end of May I found the first hatched larvæ; they are snow-white, longish, and marked with very conspicuous annulations round the body. As soon as they are born, they leave their chamber, and arrange themselves in the passage one after the other; so that the whole passage from one chamber to another is filled with them, and each has an equal portion of food allotted to it. The food is, as has been said, ambrosia, prepared by the mother.

In the mean time the female again lays from seven to ten eggs in another chamber, which are hatched in the course of a few days. The young larvæ again arrange themselves in the new passage allotted to them, one after the other. The female lays her eggs in a heap in the same manner, the third or even fourth time, being about thirty or forty in all. We therefore find in the passages which a female has made, sometimes half-grown, and sometimes full-grown larvæ, and even beetles not quite fully formed; a proof that the female lays her eggs at intervals, forming her passages as before, and continues doing so till the month of June.

The young larvæ grow very rapidly, as on the 12th of June I found some already full grown, and ready to enter the pupa state. They are not strictly speaking chrysalides, enclosed by a close substance, as is the case with the caterpillars of butterflies, but somewhat stiff, without much activity; in this case they are called Nymphs. Before they assume this state, they form a fine skin over the abdomen, by means of which they move themselves energetically about. In a short time, the head and thorax of the future beetle are formed, also the wing-cases which hang over the middle part of the body in one mass, somewhat in a slanting direction.*

In my opinion the larvæ do not make any new passages during the period of their growth, as is said to be the case with the destructive forest bark-beetle (*Scolytidæ*), according to Bechstein; at least I have formed an opinion, which I believe to be well founded, that the larvæ always lie in rows one behind the other, in passages made by the mother, and when they become larger, they completely fill them, so that those in the middle can neither move backwards nor forwards, and therefore are firmly fixed in the place which they first occupied. Those in the middle passages would only make others at the side towards the bark; but I never found one where there was a larva, although I split and examined many branches and stems which contained larvæ. I had all the branches and stems of my trees in pots which were destroyed by these beetles brought into the room, cut in small pieces, and laid in a large box. As I had nearly a hundred such pieces, each of which was bored, and the eggs or larvæ of the beetle concealed in them, I split one of them almost every day, in order to ascertain what was going on in the passages and chambers. In many passages I found some half-grown larvæ as above observed, along with those fully grown, or already transformed to the beetle state; most of those half-grown had their heads only on the lowest part of the furrow, because they had not space enough to lie at their whole length in it. Perhaps they did not belong originally to this furrow, but had wandered here for want of nourishment, and had occupied the spaces between the full grown larvæ to consume the little ambrosia which they had left. If they required wood for nourishment, there was no scarcity of it, as they lived amongst it. Although I found small hollows in the place where I discovered the half-grown larvæ, yet I found no deep hollow places in the wood, which must have been the case if the wood had been their usual nourishment. They might certainly eat the black crust which is under the white substance, or ambrosia, but scarcely except in extreme necessity would they attack the wood. In all my examinations I always merely found the passage widened when the larvæ were full grown, which must indeed be the case after the ambrosia, and even the black crust found under it are for the greater part devoured. When, however, the young larvæ in the passages are only half grown, or still small, the female might get between or over them in the passage to lay her eggs. This is really done sometimes, when she will not make any more passages, and when all those that are already made are filled; because I found eggs sometimes in the spaces between the young larvæ, and sometimes lying on their backs. The larvæ produced from these eggs may certainly at a future time be obliged to depart from want of food or space.

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* I presume that Schmidberger here meant to indicate the peculiar nature of the pupa of coleopterous insects in general, to which that of the ***Bostrichus dispar*** must of course be assimilated. On casting off the final skin of the larva, the pupa at once appears in its proper form, having every part of the body inclosed in a distinct but very slender pellicle; the wings, wing-covers, and legs, lying close together upon the breast, not having attained their full size.

On the 24th of June, I found in most of the furrows one or more fully formed beetles, and in rows as the larvæ were laid before. They were perfectly red, except a blackish spot on the hinder part of the wing-cases, and were still perfectly soft. I also found some among them which had a white pellicle over their wing-cases, through which the reddish colour shone, and I saw one in the act of drawing this pellicle over its abdomen. This is the fine nymph's skin, under which the beetle is formed, and which it pushes off, and leaves behind as the butterfly's chrysalis, casting off the final skin of the caterpillar. Several weeks pass away before the beetle is strengthened in the wing-cases, and assumes the blackish colour which it has in its perfect form. Till this time, it lies almost immoveable in its furrow, and only begins to move when it is taken out of its abode. First the head becomes black, then the other part of the body, and finally the wing-cases.

I was particularly surprised invariably to find the female in the furrows if I split a stem which contained her brood. This is quite comprehensible during the first week of her appearance, because, as we have seen, she takes a long time to lay her eggs, but I found her there after she had done laying her eggs, and when the larvæ had nearly attained their full size, and even when some of them had changed into the beetle state. Is she employed preparing ambrosia for the young larvæ, or is she keeping watch over her offspring, so that no insect enemy may approach them? There is some probability in this supposition, because I saw her also in the chambers and passages, and often in the entrance itself, where the top or highest point of the wing-cases can be seen from the exterior. She came to the entrance when

I seized the branch in which the young lay to cut it off, as if she wished to see or ascertain what was going on without. She soon, however, turned round, or went farther in the entrance when I began to cut off the branch. In the month of July I found the female surrounded by her offspring, the greater part of which had become beetles, and I only found her dead when all the larvæ had changed to pupæ and the greater number of the latter had become beetles, and were fully grown. This bark-beetle is therefore thus distinguished from those mentioned by Bechstein, the females of which, he says, die soon after they lay their eggs. It is possible that the male dies soon after pairing, as I never found an old male in any of the rooms or passages; and thus, if not dead, they must have dispersed themselves about the garden after pairing. The only males which I have met with, were very young ones, which I found in the branches of the trees in pots which I brought into the room. Their number is few in proportion to the females, as among thirty beetles I found generally only six or seven males, and sometimes not so many.

According to Bechstein, the common bark-beetle has two generations in warm summers. It is possible that the Apple bark-beetle just treated of has also two generations, but it does not appear to me very probable, because those beetles which first make their appearance have not their proper colour and strength till July, and a considerable time elapses before they are strong enough to pair, which is also the case with many other beetles. Should the female not lay her eggs till August, the time would be too short for the young larvæ to change to the perfect state before the cold weather sets in, and they would therefore in all probability perish.

With respect to the destruction of these insects, their history shows, that the only way is to cut off the branches that are infested with their eggs, and should the trunk be also attacked, the whole tree must be cut down, and conveyed out of the orchard, which need not be regretted, as it would soon die if left to itself. In 1835 I saved our orchard from this destructive guest, and these beetles were only to be found on one plum-tree in a pot. In the spring of 1835, I only examined the apple-trees in pots, because they had suffered the most by them; and when I afterwards looked at the plum-trees in pots, I found one of them attacked in three places, and nearly dead. The females probably came from that apple-tree in a pot, a branch of which I had overlooked in 1834, which had been attacked, and contained young. The other beetles probably died during the autumn or winter, or concealed themselves somewhere. It is difficult to observe when these beetles come on a tree, because they are so very small, that they are easily overlooked. They are, however, not shy, and may be readily taken by the hand.

Just as I had finished this paper, I received from one of our members M. Blumauer, a clergyman in St. Gothard, in Muhkreise, two pieces of the trunk of an apple-tree which were two and a half inches thick, and everywhere pierced by the bark-beetle. When I split one piece, I saw the passages and rooms as above described, and in which were large and small larvæ, among which, some were so fully formed, that the forthcoming beetle was discernible. The ambrosia was therefore in some passages entirely consumed, and in others only partly so. This was on the 24th of June, 1835. The same gentleman also mentioned that this beetle had destroyed many of his trees for several years past, and particularly in 1834, when the beetle was very abundant. With him they attacked the dwarf apple-trees the most, and always those that were the most healthy and best grown. As his orchard is for the most part surrounded by a forest, it is probable that the beetle comes from it, and it is therefore very difficult to protect his fruit-trees from its attacks. [Schmidberger*.]

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* The *Xyloterus dispar* is exceedingly rare in this country, so that I have had no opportunity of verifying the observations of Schmidberger as to its habits. It belongs however to a tribe of beetles whose economy is well known, and in which the larvæ of all the species whose habits have hitherto been noticed burrow beneath the bark,

THE SMALL BARK-BEETLE. *Scolytus hæmorrhous*, Mey.

In the middle of May, as I have already stated, I had several apple-trees in pots which I threw out, because they had been attacked by the apple bark-beetle, and had partly begun to wither. I let one of them lie in one of the beds with the ball of earth attached: after I had cut off all the branches that were attacked by the bark-beetles, I examined this little tree in order to ascertain if I had overlooked any part of the stem that was pierced by them; but instead of these pierced places, I found several very small holes in the stem, of which the whole length was half fresh and half withered, and indeed they were also on the still unwithered part of the tree. I saw at the same time very small beetles there, that were just beginning to pierce the bark. I cut away the stem from the stock, and brought it into the house to obtain as much practical knowledge of the economy of these insects as possible.

This beetle is a *Scolytus*, and according to modern Entomologists is the *Scolytus hæmorrhous*. Mr. Ulrich, the Royal Official Account-keeper in Linz, a zealous, and deservedly celebrated Entomologist, ascertained its name for me, which I could not find anywhere. It was black, and only the ends of the wing-cases were reddish in most of the specimens which I saw. The feet were of a brownish red, and the wing-cases furrowed lengthwise, and distinctly spotted. It was only two-thirds of a line long, and scarcely the half of a line thick. Some of these beetles, probably the males, are only half a line long.

I cut the stem of a tree in a pot into several pieces, and put them into a box, and even under these circumstances

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devour the soft inner bark or the wood beneath the bark, and form distinct channels diverging from the place where the eggs were deposited. The facts related above of the larvæ remaining in the burrow formed by the females and feeding upon the substance to which, rather fancifully, the name of Ambrosia is applied above, are new, and if correct quite at variance with the recorded habits of the family.

the beetle did not allow itself to be disturbed, but penetrated deeper into the bark. A few days afterwards I took part of the bark from one of the pieces close to the sapwood, and found that the inner bark and the greater part of the length of the stem was full of passages and hollows, and many of them extended a few lines deep into the sapwood. A white egg lay in each furrow, which after a few days produced a white larva. As the mother had not prepared any ambrosia for her offspring, the young were obliged to be satisfied with the bark, and in cases of necessity the sapwood itself; they gave the preference to the bark, and fed on it entirely even till autumn. They only left the outer part standing, probably to serve them as a protection from rain and frost. The young wood, or the sapwood as it is called, appears only to be attacked by the beetles when the bark and the inner bark are consumed. I found many shallow furrows in the sapwood and deep holes only here and there.

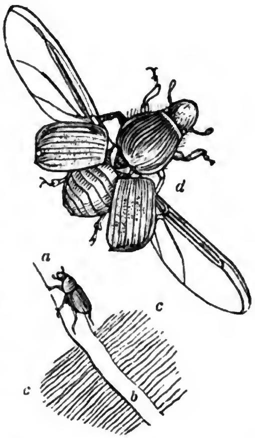
The larvæ went on eating till late in the autumn, in order to attain their full size; they then began to be stiff, the time for their assuming the pupa state coming on. As I kept the parts of the tree in the room I lived in, the transformation of the beetle was hastened, and consequently about the end of February, 1835, I found a few fully-formed beetles under the upper part of the bark, which had already stripped off the pellicle of the pupa, or had begun to do so. They were besides not agile, but were completely at rest lying in their passages. Most of the larvæ were still in the pupa state, and did not become perfectly developed beetles before the end of May. They left their dwelling in April, probably to wander forth in the open air, and again to propagate their species.

From this short history of the Scolytus in question, it is evident, that when any tree is attacked by it in great numbers, that tree must perish; because no tree can continue to grow with an injured bark and pierced sapwood. Since then, I have not seen this beetle on the fruit-trees, nor on the lopped branches which sometimes lie for a time in the garden, although it is possible I may have overlooked it on account of the smallness of its size. It therefore appears that its usual abode is in the forests, and that it is only seldom found in the orchards. Moreover in the year 1834, I did not find it on any of the healthy trees, though they did not stand far from the place where the half-withered apple-tree lay. It is probable, that it only attacks trees that are sickly, although it at first attacked the still fresh side of the tree for its purpose, and the other side afterwards. It also appears to multiply very fast, as the few females which I allowed to take up their abode in the stem of the tree laid so many eggs, that the larvæ that were produced from them destroyed the bark of the stem nearly a foot long. They cannot easily be eradicated, or at least diminished in numbers, but by removing the trees attacked by them. As they do not leave their dwelling till April, the whole winter, and even to the end of March, is time enough to convey away the trees which they have attacked.

Although I never saw this beetle on fruit-trees, except in 1834, I did not wish to pass it over in silence; first, because it attacked an uprooted apple-tree, although half-withered, and we do not know whether it may not sooner or later visit our gardens in greater numbers, and commit ravages on our fruit-trees; and secondly, because the history of this beetle will probably be welcome to the forester and the proprietor of forests, and not without use to them, as well as interesting to the Entomologist. [Schmidberger.]

THE COMMON ELM-DESTROYING SCOLYTUS. *Scolytus destructor*, Oliv. *Hylesinus scolytus*, Fabr.

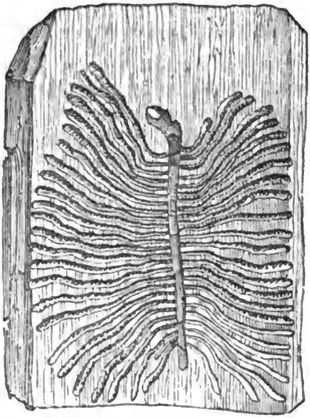
An insect allied to the destructive apple-tree Scolytus, described by Mr. Schmidberger, viz. the common Elm-destroying Scolytus, (*Scolytus destructor*,) commits great ravages on our fruit and other trees. During my stay at Grinzing, at the foot of the Kahlenberg, near Vienna, I observed that the plum-trees which with other fruit-trees grew in abundance in the vineyards, and particularly on the banks of a brook, had often several of their branches withered; and indeed some of the trees were entirely destroyed. Upon closer inspection, I saw innumerable round holes. I immediately loosened the bark from the stem, and under it I discovered that well known beetle, the *Scolytus destructor*, in its perfect state, as well as in that of the larva. Dr. Hammerschmidt made the same discovery in Hadersdorf in the neighbourhood of Vienna, only he thought the insect was a different species, and called it the Plum Scolytus (*Scolytus pruni*), on account of its abode on the plum-trees. Except its being smaller, however, I found no distinction between the specimens collected by me, and the common *Scolytus destructor* described in different works on Natural History.



Perfect insect, natural size *a*; channel *b*; inner bark *c*; perfect insect on the wing magnified *d*.

The perfect insect or beetle is only two lines long, and the majority of them are still smaller; its breadth is about half a line, and its form is almost cylindrical, and tolerably firm to the touch. The head and thorax form the principal part of its body; they are black and shining, very finely and thickly-dotted, and the former covered with short yellowish-gray hairs. The antennæ are of a light pitch-brown, ending in a knob. The wing-cases are, as it were, obliquely cut off behind, and at the base near the thorax somewhat hollowed; they are marked in lines, which are dotted, as well as the spaces between them: their colour is pitch-brown.

The abdomen from the base to the apex is as if slantingly lopped off and, like the thorax, of a dark pitch-brown, thickly dotted. The legs are of a reddish brown, with the second joint or the tibiæ tolerably broad. The larva, according to Dr. Hammerschmidt's description, and a drawing which he sent to the Royal Agricultural Society, is of a yellowish white, and has a proportionably large yellowish shining head, and a brown mouth. It is from one to two lines long. There is a whitish transparent swelling between the head and the first ring on the throat, which seems to be a characteristic sign of the larva of this species. They confine themselves to the inner bark, form winding paths in it, and destroy by degrees this part so important to the nourishment of the tree, whence the tree itself or some of its branches must perish.



The only remedy against the ravages of this insect is felling and carrying off the trees attacked by it, by which the other sound trees may be secured. This work must be undertaken late in the autumn, in winter, or early in spring, at the time when the insect is still in the larva state; for if the perfect insect or beetle makes its appearance later, it lays its eggs on the other neighbouring trees. The necessity that the felled trees or lopped branches should be immediately burned, is at once apparent.

This *Scolytus* also attacks other trees; and a few years ago it attacked and destroyed a great many of the elms (*Ulmus campestris*) in the islands in the Danube; viz., those in the Prater. A more extensive general attack was, by the activity of the ranger, Baron Binder von Kriegelstein, completely prevented, by merely felling and carrying off the attacked trees *.

THE PLUM SAW-FLY. *Tenthredo morio*, Fabr.

As the larva of the apple-weevil only attacks the blossoms of the apple and pear-trees, in like manner other insects only attack the fruit, and apply it to their use. This is particularly the case with the plum-trees; the fruit of which many insects take possession of. Perhaps some may already have remarked, that the green-gage and other round plums are attacked when they are hardly the size of a pea, and fall off in the course of a few days. This is caused by a saw-fly, which makes use of the pulp as food for her offspring, and which is the above-named plum saw-fly (*Tenthredo morio*).

Seen at a distance, this saw-fly resembles a small house-fly; but it is strikingly distinguished from a fly by its having four wings, whereas the house-fly has only two wings. The head and body are completely black, and the feet of a reddish-yellow. It will not be easily mistaken, as I know of no other flies that appear in spring, with reddish-yellow feet, on the trees in blossom.

As soon as the blossom-buds of the plum-trees begin to expand, the insect appears, pairs, and then begins to lay its eggs. For that purpose it selects the largest kind of plums; and, fortunately for us, it does not find the damson so well suited as others for the purpose. When it finds a suitable tree, it lays its eggs in the notched part of the calyx of the flowers; that is, in the upper parts or laps of the green envelope of the blossom. It cuts in obliquely with its saws without completely piercing it through, and immediately introduces the egg into the deepest part, so that when it flies away, nothing is seen on the exterior but two very small brown spots.

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* Without attempting to settle the question as to the specific distinction of *Scolytus pruni*, and *destructor*, or to assert that they are identical, I must be permitted to allude to the numerous facts recently observed, connected with the economy of the elm-destroying *Scolytus*, by Messrs. Audouin and Spence, and communicated by them respectively to the Entomological Societies of Paris and London.

Of these discoveries a summary, with additional practical observations, has recently appeared in the *Arboretum Britannicum*.

The egg is very small, greenish-white, and transparent. It is hatched in the course of a few days, and appears a delicate whitish larva, with a dark-brown head, six pairs of middle feet, three pairs of fore feet, and one pair of anal feet. It immediately leaves its birthplace where there is no suitable food for it; and hastens to the plum growing near it, which is then scarcely the size of a hemp-seed, and attacks it. It fixes itself in the centre of the plum-stone, which, being tender and milky, affords it the best nourishment. The plum in the meantime continues to grow, and the larva with it, so that the latter never wants for food. It has attained its full size in six weeks, when it is ready for its final destination. The plum then drops to the ground, when the insect buries itself in the earth, and surrounds itself with a covering. It remains in this state till the forthcoming spring, when it undergoes its last transformation, and appears again out of the earth as a perfect saw-fly, which again ascends the plum-tree, and continues its species.

Great is the mischief that these saw-flies often commit on our plum crops; indeed, sometimes they hardly leave a single plum on the tree, as was the case in 1822. At that time I had the plums counted on a tree which bore the white Magnum Bonums, which tree was infected by the larva of this insect, and the number was eight thousand. Only three plums on the tree remained healthy. The weather was uncommonly favourable to them that year; they could lay their eggs without interruption, and the forthcoming larva or worm found no obstacle to its attaining its full development. The fly itself seems to know that it is necessary to have particularly fine weather, to obtain its object of propagating its species; the female only permits herself to be seen on warm days, usually at eight o'clock in the morning; and at mid-day she is most zealously employed in laying her eggs. She conceals herself early in the evening, and also when rain or wind comes on. Therefore, I have always found the plums least injured by this insect when a continued rain set in at the time when the plum was in full blossom. A German proverb is very applicable in this case; viz., "If the plum crop is abundant, it must have rained during the time of blossoming."

Unfortunately we have but few means in our power of protecting our plum-trees from this insect, or of diminishing its numbers. Till now, we know of no other but taking away the saw-fly itself, and removing the plums, in which the larva are contained, from the tree, and conveying them out of the garden when they have fallen down. It is not difficult to catch the saw-flies at the time when they are occupied in laying their eggs, or when they are sucking the honey out of the embryo of the blossom, as they have their heads at that time in the blossom, and therefore are easily caught. This is indeed not easily accomplished on plum-trees with high trunks; but it may be effected on dwarf and espalier trees, if we accustom ourselves to visit them daily, and practise capturing them.

To lessen the number of these saw-flies, at least for the future, the second method is also efficacious; viz., taking the plums, that are infested by the larva, from the tree, and destroying them. Those who have good eyes can see, at a single glance, the plums in which these destructive guests have taken up their abode; because a small opening is apparent in the plum, which has a blackish appearance, from the issuing of the sap, and the rejected excrement. The taking off the plums that are attacked must take place as soon as the small opening is perceived. Besides, the plums that fall must be picked up every day and conveyed away; and this ought not to be neglected, either as it respects low or high-stemmed trees. In many of them only the worm or larva will be found, if they are attended to early enough; and this proceeding will contribute essentially to diminish the number, the beneficial consequences of which will certainly be experienced the following year. [Schmidberger.]

THE PEAR SAW-FLY. *Tenthredo hæmorrhoidalis*, Fabr.

The plum saw-fly only attacks the plum-tree to obtain the fruit of it for her offspring; and another kind of saw-fly only attacks the pear-tree to lodge her young there. This last species is called the pear saw-fly (*Tenthredo hæmorrhoidalis*).

This saw-fly is somewhat larger than the *Tenthredo populi*. It measures, from the front of the head to the extreme point of the body, four lines, and it is two lines in breadth. Its long antennæ consist of numerous joints, the basal part of which is very thick and long, the second much thinner and shorter, and the third the longest of them all. The other joints, sixteen or seventeen in number, are gradually thinner towards the tips, and somewhat longer than the second; yellow towards the tip, and blackish-brown near the head, the first three being, however, yellow throughout. The head is black, with a yellow triangular spot between the antennæ. The breast and the upper side of the thorax are quite black, the first abdominal segment likewise black, but surrounded with yellow; the other segments are orange-yellow from the plates to the two edges, by which the upper part of the abdomen is united to the belly. These plates are of a light-yellow colour. The wings look glassy, with a dark-brown mark round the edge, and an obscure kind of stripe, which extends across the whole breadth. The three pairs of feet are of an orange colour, and the tibia, close to the knee, surrounded by a broad black ring.

The pear saw-fly appears usually late in May, some of them only in June, if the warm spring weather sets in late. The female lays from forty to sixty eggs, and almost always on the under-side of the leaf, therefore it cannot easily be seen while it is laying its eggs. The eggs are attached to the leaf, and lie in rows one after the other, but always according to the art of the bricklayer, viz., one row of eggs quite regular, and the second so placed, that the eggs in it cover the junction of those in the first row. They are longish, yellow, and appear as if besmeared with mucus. The caterpillar, which is hatched in a few days, at first is of a whitish-yellow, but becomes darker every day. As soon as it is exposed to the light, it spins a web over itself, the threads of which proceed from its mouth. The caterpillar never appears out of this web, and when it has partly eaten a leaf, it spins itself a web on another, and always in company with the other caterpillars. It has a black head, and immediately under the throat two black dots; the other parts of the body are ochre-coloured, and transparent, without hairs. It measures from nine to ten lines long. The two fore-feet, and the two upon the last segment, are finely tapered, so that they rather resemble claws than feet, because they do not use them for crawling, but to draw themselves out of and into their webs. These caterpillars attain their full size in five weeks; they then leave the tree and bury themselves deep in the ground. They do not appear again as saw-flies till the following spring to propagate their species. It remains to be observed, that if the saw-fly does not find a suitable pear-tree close by, it attacks the leaves of a plum-tree to deposit its eggs there, which was the case in 1824, when these insects were so numerous.

The caterpillar of this saw-fly has a dangerous enemy which penetrates into its body externally, and consumes it even to the skin; and this enemy is the caterpillar or larva of an ichneumon fly (*Ophion mercator*). When the caterpillar of the pear saw-fly has nearly attained its full size, and before it takes up its abode in the earth, the above-named ichneumon lays an egg in its body. The caterpillar of the saw-fly buries itself in the earth with this deadly enemy in its body; and the grub that is produced from the egg feeds upon the body of the caterpillar, uses its skin as a covering, and the following spring is transformed into a perfect ichneumon, so that instead of a saw-fly the former makes its appearance out of the ground.

These ichneumon flies have a very thin body four lines long; the head, collar, and thorax, are black, as well as the antennæ. The abdomen is bent into the form of a sickle, and united to the breast by a peduncle, becoming thicker towards the end, which is furnished with a visible sting. The peduncle is black, the first ring of the abdomen is partly black and partly red, the last black again, and the second and third red. The hind feet are much longer than the fore feet, and reddish to the knees, which are black.

Although the pear saw-flies are much diminished in number by means of the ichneumon fly, and therefore are neither very numerous nor very destructive, yet we cannot suffer them on our pear-trees, as they almost always only attack our dwarf-trees, and strip many of the branches of their leaves, they therefore do serious injury to them. Besides, their webs are unsightly on the trees, and should be removed as soon as possible *. [Schmidberger.]

The Peach or Poplar Saw-fly. *Tenthredo populi*, Linn.

To those insects which only attack the leaves of fruit-trees, and use them as food, belongs the peach saw-fly (*Tenthredo populi*). At a distance it looks like a house-fly, it is only somewhat longer, has also a thinner thorax, and, like all hymenopterous insects, it has four wings. It is black, and only on the hinder part of the body, the back and the abdomen, are seen whitish square incisions, which extend on both sides towards the middle, without intercepting one another. They have simply jointed antennæ, yellow palpi and feet, the thighs of which are black, and the tibiæ, however, yellow.

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* This and the following species of saw-fly, not only from the description of the antennæ, but also from the structure of the larva, destitute of abdominal legs, and from the habit of living in society in the larva state, evidently belong to the genus *Lyda*. De Geer has given the history of one species of this genus, the habits of which correspond with those described by Schmidberger, being also found upon the pear.

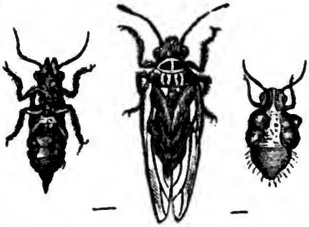
As soon as the first leaves of the stone-fruits are unfolded in spring, this saw-fly visits them. They therefore appear early, usually about the middle of April, and attack the peach, apricot, and plum-trees. When they lay their eggs, they choose those days that are particularly still and warm. When they find a suitable leaf, they fix themselves firmly on it, and lay their eggs on it in rows one after another, from thirty to forty in number, not all at once, but often disburden themselves of their eggs at different times. They are longish, cylindrical, and of a light-yellow colour.

If the weather is favourable, the eggs are hatched in a few days, and a white-greenish grub is produced from them. They no sooner begin to move, than they surround themselves with a web. Thus surrounded, they roam from one leaf to another, from which they select the best parts for their food; therefore a leaf is never found entirely consumed. They are fully grown in five or six weeks, and are about the size of the green looper of the winter moth. They are of a light-green colour, with black heads, have three pairs of fore-feet, and one pair of hind-feet, the latter of which are only used as pushers, and not for crawling. As soon as they have attained their full growth, they retire into the ground, form themselves a chamber, make themselves a dark-brown roomy case, the material for which they produce from themselves, and remain in the earth till spring, when they again appear as saw-flies to propagate their species.

The larvæ of these saw-flies are very destructive to stone-fruit, particularly to peach and apricot-trees, as they very often gnaw their leaves to pieces. Such trees look as if they were covered with spiders' webs instead of leaves. In this manner the fruit of the tree is destroyed; to the nourishment of which, the leaves are as necessary as the roots are to the tree. Whoever will give himself a little trouble, may easily protect his peach and apricot-trees from this insect. If these trees are carefully examined when the leaves are expanded, the pale-yellow eggs, which usually lie together on the point or edge of the leaf, are easily seen. If these are destroyed as soon as they are laid, so much the better for the tree, as by this means the leaves will remain unconsumed. Should an egg have been overlooked here and there, the green larvæ cannot escape our notice, as they are always surrounded with a web, and rolled up in the leaves they have gnawed. Whoever is not afraid of the trouble, can also pursue the saw-flies themselves; but this must take place only at mid-day, and during fine weather, because they are then most plentiful on the trees*. [Schmidberger.]

THE PEAR CHERMES. *Chermes pyri*, Schmidb. (*Psylla pyri*, Stephens.)

The proprietor of a garden cannot easily have overlooked those disagreeable little creatures, which in May, and throughout a great part of the summer, beset the young shoots and bearing-wood of the dwarf pear-trees in immense numbers, and defile them almost all over with their excrement. This is the *Chermes pyri*, an insect nearly allied to the plant-lice (*aphides*).



CHERMES PYRI, GREATLY MAGNIFIED.

The *Chermes pyri*, as a perfect insect, has wings, and is about the size of a large aphis. It has a broad head, which terminates in front in two cones, but there is no opening for the mouth in the head. It is situated in the middle of the breast, between the fore and hind feet. The rostrum stands out in a perpendicular direction, and ends in a point. From the latter issues the very long delicate tongue with which it sucks its food from the bark of the twigs. The female is for the most part of a crimson colour, the male in some parts more shaded with black. The wings of both are membranous and snow-white.

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* If Schmidberger be correct in the application to this species of the specific name of *Populi*, there must either be considerable diversity in the habits of the insect, feeding at one time on the poplar, and at another on the peach and apricot, or the specific name must have been applied improperly, and in such case ought to be changed, in order to prevent confusion.

As soon as the fruit-trees put out buds, the winged chermes makes its appearance. When pairing is over, the female lays her eggs in great numbers near each other on the young leaves and blossoms, or on the newly-formed fruit and shoots. They are of a longish shape, and yellow, and without a magnifying-glass they resemble the pollen of flowers. They are hatched in a few days, and resemble the apterous plant-lice, have six feet, and are of a dark-yellow colour.

They are called either nymphs or larvæ in this state (according to the extent of their development), and like their parents have their mouth in the breast. After a few days they change their skins, and become darker, and somewhat reddish on the breast, and rather resemble bugs than plant-lice, having the extreme point of the body somewhat broad, and beset with bristles. After changing their skins they leave the leaves, blossoms, and fruit, and proceed more downwards to the bearing-wood and the shoots of last year, on which they fix themselves securely one after the other in rows, and remain there till their last transformation. At this time they begin to defile the twigs they infest with their excrement, and they discharge such a copious fluid, that it often hangs at the extreme point of the body like dew. The ants are eager for this fluid, therefore they are sure to be found where the chermes is in the nymph state.

When the nymphs have moulted for the last time, and have attained their full size, the body swells out by degrees and becomes cylindrical. They then leave their associates, and, before they lay aside their nymph-like covering, they search out a leaf to which they fasten themselves firmly, and appear as if they were lifeless. After a few minutes the skin splits on the upper part of the covering, and a winged insect proceeds from it. It is of a pleasant green colour, with red eyes, and snow-white wings. It very much resembles its parents in spring, even in the colour. After a few days, this chermes has assumed the colours of the perfect insect; the head, collar, and thorax, are of an orange colour, and only the abdomen retains its green hue. It now flies away from the place of its birth to enjoy the open air. Thus it lives in the garden throughout the summer, and late in the autumn it selects for itself a place protected from the cold, and appears in the first days of spring in its crimson black-shaded clothing to begin the work of regeneration.

Uninjurious as the winged chermes in its perfect state is to fruit trees, it is in proportion as destructive to them as a wingless insect, because it feeds as we have seen on the sap only, which it sucks out of the bark of the twigs. If several hundreds attack a small dwarf pear-tree, it may be easily guessed how much the tree will suffer. It very soon assumes an unhealthy appearance, its growth is at a stand, its leaves and shoots curl up, and the tree dies by degrees if not freed from its troublesome guest. It is also necessary to keep an attentive eye on these insects, and to clear the tree from them as soon as possible. This is effected in the easiest manner, if the young are brushed off with a stiff brush, or with a pencil made of pig's bristles, those that fall being trodden upon and crushed to death. The best method however to protect the dwarf pear-trees from them, is to search out and take away the winged chermes throughout the month of May as soon as the trees begin to blossom and the shoots to grow. Their red colour and long wings make them not easily overlooked, and as they are not shy, they are easily caught by the hand. [Schmidberger.]

THE APPLE CHERMES. (*Psylla mali*) *Chermes mali*, Schmidb.

I shall now lay before the friends of fruit-tree culture and natural history, the history of a small insect, which indeed is not so destructive to fruit-trees as most of those I have already treated of, but which still must be reckoned among those that are injurious. This is the Apple Chermes (*Chermes mali*), so named because they are seen only on the apple-trees, feed on their juice, and only in this manner become injurious. As they very much resemble the Pear Chermes (*Chermes pyri*) in the larva or nymph state, as well as in the perfect insect, I was at first of opinion that they might have nearly the same economy; but as I observed them more closely, I found a striking difference between the two species. I laboured for two years in vain to ascertain their time of pairing and laying their eggs, which on account of the smallness of their size are easily overlooked. I was soon convinced that they do not lay their eggs in spring, as I at first supposed, and as is the case with the *Chermes pyri;* because at that time neither a male nor a female was visible, only their larvæ; and indeed these larvæ were seen much earlier than those of the Pear Chermes. In the beginning of September, 1832, after repeated trials, I found perfectly-formed eggs in the abdomen of the female, and thus attained my utmost wish, as this gave me the key of its natural history.

It is in the month of September then that the apple-chermes pair and lay their eggs. On the 1st of September I found full formed eggs in the abdomen, and on the 6th I already saw some pairing. The eggs are perfectly formed in the body of the mother before pairing takes place, as is the case with the Apple Aphis (*Aphis mali*). Before they pair five or six of them assemble on an apple-leaf, and indeed, usually on one that has become somewhat yellow, and each male selects his female. The males are in wedding attire, either of a lively green striped on the back with yellow, a dark yellow with brown stripes, or almost completely green with dark yellow dots; the abdomen is entirely yellow. The females are of a prettier colour, and somewhat larger; the entire back of the female reaching as far down as the forceps at the extremity of the abdomen is red, striped with greenish-yellow and brown, and the abdomen is orange-yellow or green; they are green, or greenish-yellow on other occasions.

On the 9th of September I already found that a great many apple chermes had paired. While pairing is going on, a strong tubercle appears on the last ring of the extreme point of the body, which remains there till pairing is over. Some of the females begin to lay their eggs during the first fortnight of September. They are white, and pointed at both ends, a line and a half long, and the fourth of a line thick, and become yellow before the young escapes.

The apple chermes lays its eggs on different places of the twigs of an apple-tree; usually however in the furrows of the knots, and sometimes in a very regular manner. I saw one furrow with the eggs regularly arranged in rows, one egg lying close to another. It is very seldom that an egg is found within those buds on which the escaped nymph fixes itself in spring. The females also often lay their eggs on shoots of a year old, particularly when these shoots are covered with fine hair; but the eggs are then laid singly or in heaps together without any order. The insects however know how to stick them on so fast, that rain cannot easily wash them off. I never found an egg on the leaves; indeed if so situated they might easily be lost, because when the leaves fall the young would be too far from their food. These insects are subject to a kind of disease, which appears to deprive them of the power of eating; as in this case, the leaves on which they are found are not in the slightest degree injured. When thus affected the head and thorax of the insects are snow-white, and their abdomens are ringed with black, whereas when they are killed by a pin, their original colour remains unchanged a long time, and they become at last of a dark yellow.

To obtain a more certain knowledge of the natural history of these insects, in spring I selected two apple-trees in pots for observation, on the twigs of which were many eggs; as I however placed them too soon in the room, very few of the eggs were hatched. I afterwards brought some shoots with eggs on them into my room, and put them in water as early as the month of January. The buds soon began to sprout, so that the shoots became a finger-long, but no larva made its appearance: the eggs were dead. I repeated the same in February, and the result was the same. On the twigs, however, which I put in water in my room towards the end of March, young appeared out of all the eggs, as soon as the buds began to sprout; though probably the warmth of the room brought them forward before the time when nature had prepared them for their escape, as the heat forced them on so fast that they soon withered up.

I then placed some other trees in pots in my room, which began to sprout about the 5th of April, and simultaneously with the leaves the first larva appeared. Its eyes were red immediately after birth, its feet black, and its body of a dirty yellow with four rows of dots across the back; the abdomen was brown and annulated, and the extreme point of the body, which was covered with whitish hairs, was somewhat broader than the abdomen, and of a dark brown. The larvæ were scarcely escaped from the egg into the open air, when they hastened to the nearest bud, and began to gnaw its scales, because the bud was only somewhat swollen, and had not begun to sprout. As the nights in April are generally cold, and the weather is still very changeable, they did not remain in the open air, but penetrating through the scales of the bud, they buried themselves in it, and were thus protected from the rain and cold. Others ascended to the top of the buds on the trees in pots in my room, and on those of the twigs in water, which were already so far advanced that the small green leaves were apparent.

On the second day after their birth, I found they had already cast their first skin, after which they appeared nearly of their former shape and colour. Immediately after changing their skin, there issued from the extreme point of the body a whitish transparent tubercle, nearly as large as themselves; after which appeared a whitish thread, to which the tubercle remained hanging. All the young ones which had cast their second skin had this. The whitish thread, which was smooth and round like the string of a violin, was often bent upwards, and moved the tubercle on the back, so that it often happened that nothing was seen of the insect but only the tubercle, which looked like a ball moving backwards and forwards. As a proof how burdensome this weight must be to the insect, I observed a larva squeeze itself between the scales of a bud, apparently to free itself from the tubercle on its back. When the tubercle and the string fall off, which usually happens when the string is tolerably long, another tubercle appears immediately, and after it another string. This continues till the second changing of the skin, which follows a few days afterwards.

The second changing of the skin can sometimes be scarcely seen at all, because the larva not only puts out a thicker string with the tubercle, but also an immense number of very fine entangled threads or small hairs, which it turns upwards over its back, and with them entirely covers its body and head. In sunshine these strings look transparent, as if they were made of glass, and become of a greenish variable colour. Under this screen the chermes are secured from every attack of other insects; for no ants, mites, or bugs can disturb them in their fortification or consume them as their prey.

It is only at an earlier and more unprotected stage of their existence that they can be attacked with success, as I have witnessed several times.

With regard to the ants, they are not very troublesome to this insect, and indeed they are seldom seen in its abode, because they prefer pursuing the pear chermes. They find but little attraction in the apple chermes, because the juice which they are in quest of is not ejected by it, and its tubercle contains only a tough, thick mucus, which does not suit them. The string, which, with the tubercle, forms a kind of excrement, consists of nothing but small hairs, which are so fine that they are reduced to powder when blown upon. These insects are not provided with horns at the extremity of the body, like those the aphides have, and from which the fluid continues to issue which the ants are so eager to obtain. Though ants are not injurious, the mite and bug are destructive to the young apple chermes. I saw two mites, one of a deep red, and the other of a dirty yellow, which pursued and sucked the young of this insect; and of all the young that were produced on the trees in pots in my room, only two were left me, and even these would have been destroyed before the second time of casting their skins if I had not taken them away. I also found in the open air, a light-green pupa of one of the garden bugs, which pursued the young apple chermes, pierced them with its rostrum, and devoured them. The bugs and mites above mentioned are all very eager in pursuit of the aphides, which serve them as food.

After changing the second skin, the young assumed a different colour and form; they now became light-green all over, the abdomen was much broader than the thorax, and on the side of the latter, rudiments of the wings were distinctly seen. The tubercle, with the string attached, remained hanging to the cast-off skin, as well as the curly small hairs, while the insect left the place where it had changed its skin and searched out for itself another spot. No sooner was the changing of the skin over, than another tubercle, and the string after it, appeared at the extreme point of the body; but it was now much larger, and before the string broke off, it was some lines long. In a few days the whole insect was covered, partly with filaments, and partly with fine curly small hairs, so that in this state it had a very extraordinary appearance.

The third time of changing the skin comes on in about eight days, sometimes sooner and sometimes later, according to the weather. After this skin, the wing rudiments very distinctly make their appearance, and become larger and whiter the nearer the insect approaches to the perfect state. The body is also of a light-green, and the larvæ have black eyes and blackish antennæ. After this moulting, another tubercle and filament appear from the abdomen, and again, with the filament, numerous fine curly little hairs of a light-blue varying colour, with which it becomes entirely surrounded. At last the time arrives when the insect assumes the perfect state; when it retires to a part of a leaf which it had selected, and, after having firmly fixed itself there, the back splits open, and the beautiful winged chermes appears from the nymph. In the formation of the body of the perfect insect, it exactly resembles the pear chermes (*chermes pyri*), it is, however, different from that species in colour, because instead of having red eyes, they are of a snow-white, with a black pupil, the back of the thorax is of a light-green, the abdomen is marked with yellow rings, and the membranous wings with strongly-marked snow-white veins. The snout, which contains the setiform tongue, is situated, like that of all the species of chermes, in the middle of the breast, near the two fore-feet, and is something more than a line long; the tongue, however, which can extend to the extreme point of the body, is much longer.

After accomplishing this last transformation, the insects remain almost a whole day on the spot sitting in perfect repose, and then disperse in the garden. On the 5th of April, as has been stated, the first of my larvæ escaped from the egg, and on the 30th it arrived at its perfect state. In the open air I usually saw the first perfect insect during the first fortnight of May; the time from their escape from the egg to the perfect state, was nearly four weeks.

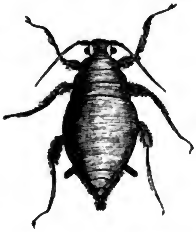
These chermes are very numerous some years, as in 1832 and 1833, and also in 1835. They cause indeed, as I have already observed, no great destruction, but when they are very numerous many blossoms are destroyed by them; because when all the single-standing blossoms are completely covered with blisters, broken filaments, and small hairs, as is usually the case, and the flower-buds have been weakened by the previous sucking of these insects, they can produce no fruit. I often expected fruit from many small trees that had a great many blossom-buds, but these insects infested the apples which were already set in such numbers, that they caused them to fall. The same happened to many of my trees in pots, the blossom and fruit of which were entirely destroyed.

There is no other method of securing the blossom and fruit of trees in pots, or dwarf trees, but by brushing away the young chermes with a fine brush when they first appear, or at latest after the first changing of the skin takes place in the month of April; should this be neglected till the blossoms are already unfolded, they will be found covered with cast tubercles and filaments, which cannot easily be removed without destroying the blossoms at the same time. It is also necessary to examine particularly the small apple-trees in spring, when the blossoms begin to appear, to ascertain if any aphides are upon them, and thus to effect their destruction earlier. [Schmidberger.]

THE PLANT-LOUSE, OR APHIS.

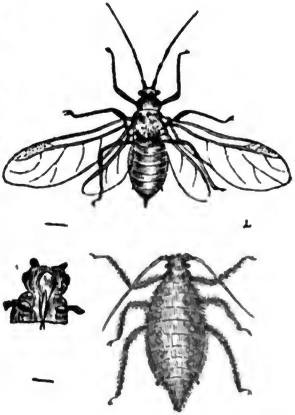
The aphides generally only attack dwarf and young trees with high stems, to which they are very destructive, if they are favoured by circumstances, and consequently very numerous. They do not indeed consume the leaves like many caterpillars, but they draw out the juice of those leaves which they attack, check their growth, and cause them to wither and die away; and sometimes they even occasion the death of the tree itself.

There are particularly three species of aphides which are very destructive to the fruit-trees, viz., the apple, plum, and peach aphides, *Aphis pyri mali*, *Aphis pruni*, and *Aphis persicæ*. All the three are



APHIS PYRI MALI, GREATLY MAGNIFIED.

green; the apple aphis is grass green, the plum aphis is light green, and the peach aphis dark green. The old females are particularly distinguished by having dark-brown spots on their bodies.



APHIS PRUNI, GREATLY MAGNIFIED.

All these three species of aphides appear in spring as soon as the leaves of the fruit-trees are visible. The peach aphides appear the first, and they are seen upon the trees when the buds are scarcely a line long. They proceed from eggs which were laid on the shoots the previous autumn, and are only females without wings. No sooner do they see the light than they disperse over the leaves and shoots near them, insert their rostrums, and begin to suck out the sap. In the course of ten or twelve days, if the weather be not unfavourable, they are fully formed, and immediately begin to produce young, and these again seem to be only females without wings. The males are first seen in autumn; at which time only, as we shall see, pairing takes place, the females being pregnant from their birth. They live from fifteen to twenty days if suffered to die a natural death, and during that time each of them brings from twenty to forty young ones into the world.

The offspring of the second generation is, if the weather be warm, again ready to bring forth in ten days at the latest. The insects of this generation do not, however, merely produce females without wings, but also those that have them; and the same takes place in several following generations. Those that never acquire wings remain in the tree on which they were born, and never leave it unless they are driven from it by force; but those that have wings fly away as soon as they have attained their full size, disperse themselves on all sides, and bring forth their young on those trees that are best suited for them. By these means they secure on one side a powerful increase of food; and on the other, they have a better chance of escaping from the bugs, spiders, flies, beetles, wasps, &c., that would otherwise prey upon them.

The newly-born females which acquire wings, and those without them of the third generation, produce young in eight or ten days; these do the same in an equally short space of time, and thus they go on till the middle of September, so that it often happens that sixteen generations in all are produced. What an enormous numbers of aphides would thus be in every garden, if they all continued to live! All our fruit-trees would be covered, and finally destroyed by them.

In the middle of September, males and females are produced from the last generation; the apple aphis producing males which do not obtain wings, and the peach aphis those that acquire wings. When these newly-born males and females have attained their full size, pairing takes place. The females then no longer produce living young ones, but lay eggs, from which the mothers of the forthcoming generations proceed. They do not, however, lay their eggs on the leaves, because these would fall off, and the eggs lying on the ground till spring would be destroyed; but they lay them on the twig or shoot itself, and either all around it like the apple aphis, or on the buds, or near them, like the plum and peach aphides; the latter sometimes laying their eggs on the matting with which the twigs are fastened to an espalier in summer. The females, having thus provided for their future spring progeny, die off by degrees in the autumn. The eggs have now only the winter to endure, which never kills them, however severe and changeable it may be.

As our apple, pear, plum, and peach trees, often suffer very much from the aphides, it becomes essential for gardeners to think of some method for lessening their numbers. With regard to the apple-aphis, there is no method more effective than destroying the eggs soon after they are laid. They may be seen late in the autumn, or early in spring, if we carefully examine the dwarf apple and pear-trees, and particularly the young trees that have high stems; because the eggs lie exposed close together on the shoots like grains of gunpowder, and yield a green juice if they are pressed. We should not, however, press them, but the shoots should be washed over with liquid loam, garden earth, or whitewash, so that they may be completely covered by it. By this means all the eggs will be certainly killed, if the wash is not swept away by rain. With regard to the plum and peach aphides, their eggs being more concealed and dispersed singly, they are not easily observed. We must, therefore, wait till the aphides are hatched, and sitting on the leaves. They are then easily observed, because they are of a dark brown, and are found sitting either on the points of the young leaves, or on the blossom-buds.

When the peach trees begin to put out their leaves, it is worth our trouble to examine them thoroughly on account of the aphides; because at a later period when they have become numerous, the trees cannot easily be freed from them. Should a peach tree have suffered very much from the aphides throughout the summer, so that we have reason to dread that they will renew their attacks the following year, recourse must immediately be had to the clay-wash. To effect this, the peach tree should be pruned very early in spring before the sap is in motion, and the eggs of the aphides hatched; and then the whole tree, leaves, and blossom-buds, should be covered with clay or garden-earth, and in this manner the eggs laid in autumn may be destroyed. This does no injury either to the blossom or leaf-buds; they will burst out from under the wash of clay, and like those that are uncovered, will produce blossoms and leaves.

The ants are of much assistance in finding the aphides in spring, as well as in summer; because wherever the aphides are, ants are found likewise; as the fluid ejected by the aphides is too delightful a food for the ants not to be eagerly sought for by them. When they ascend a tree, it is not to attack the buds and leaves, but to search for the aphides in order that they may feed on this juice. Nor is it these insects that roll up the leaves of the peach-trees: it is the aphides themselves, to protect their soft bodies from the burning rays of the sun, from the wind and weather, and from their enemies. In order, therefore, to find out the aphides, we have only to turn our eyes wherever ants are seen. If we only perceive the aphides when they have become numerous on the shoots and leaves, no other remedy remains but that of cutting those branches away that are covered with the insects; and the stragglers should be brushed off with a strong hair-pencil, or a brush. The examination must be repeated for several days in succession; because all cannot be discovered at first, and the young know well how to hide themselves. The pruning off the shoots infested by the aphides, and the brushing of the trunk of the tree, are found to be the quickest methods, and those by which the object in view is the most certainly attained, without essentially injuring the growth of the tree. All the other remedies mentioned in books on Pomology, and those in periodicals, on the contrary, either require more time or trouble, or are too expensive or injurious to the trees to be made use of. If small longish grubs are seen among the aphides, they should be spared; because they are either the larvæ of Syrphideous flies, or those of the Ladybird beetles, which are nourished entirely upon the aphides. The shoots and leaves on which these larvæ are found, will be freed from the aphides without our further interference.

Whoever wishes to keep his fruit-trees free from the aphides, must carefully examine them in June, July, and August; because, as has been said, the third and following generations bring many into the world, that soon obtain wings and disperse themselves. Others of the same kind also come from other gardens and neighbourhoods to infest our trees; but as they are generally found on the under side of the leaves, they are easily discovered and destroyed. [Schmidberger.]

The Small and Large Pear Midges. (*Sciara pyri*, Schmidb., and *Sciara Schmidbergeri*, Kllr.)

In 1830 I saw a great many rotten pears, several of which I cut open. In some I found the core eaten out and empty, or half rotten; while in others it was but little decayed, though containing several yellowish larvæ nearly a line long, and a third of a line thick, with ten segments without feet; and each having a pointed head, on which were two black spots standing close together. When I took some of these larvæ out of the pears, and put them on the ground, they immediately began to bury themselves, a sign that their transformation takes place in the earth. In this manner I easily discovered the destroyers of the pears, but not the mother from which they sprang. I, therefore, put some of the pears containing larvæ in a box, and some in a flower-pot filled with earth, and covered them with gauze. The larvæ immediately left the cut pears, and buried themselves in the earth. But no perfect insect appeared under the gauze either in summer or winter; for, as I afterwards found, they could not develop themselves, because I had neglected to keep the mould always damp.

In the spring of 1831 a great many pears again fell off, and as I could not discover the injurious insect, because I did not know, amongst the number that were seen on blossoms, to which to direct my attention, I again put several small pears, infested with similar larvæ, into a tumbler, which I filled half full of damp earth, and covered with gauze. This took place in the latter end of May, at which time the larvæ have generally attained their full size. On the 11th of May I examined the earth in a glass, which I always kept damp, to see how the larvæ were going on. There I found the larvæ in a beautifully arched chamber, lying quite unaltered and alive; and as soon as they saw the light, they began to move. In the pears which I did not cut, there lay some larvæ immoveable, which, however, as soon as they were taken out and laid on the earth, began to bury themselves. On the 5th of July, when I again searched for the larvæ in the glasses, I found them covered with a yellowish case in folds. When I stripped off the case, they also appeared lifeless. They were, however, not yet transformed to the perfect pupa, because the rings on the body which they had when alive could still be distinctly seen.

The first perfect midge made its appearance in the glass in the middle of August; and, by the middle of September, nineteen in all had come out of the earth all in one glass. This species of midge is very small, scarcely three quarters of a line long, and hardly a quarter broad. The antennæ are cylindrical, finely haired, and composed of sixteen joints, with the two basal joints thicker than the others. The abdomen is slender, seven-ringed, and finely haired; there is a knobby two-jointed pair of forceps on the extreme point of the body of the male, and the same part of the female is pointed. The wings lie in a parallel direction, and are microscopically haired. The feet are long, thin, and finely haired. According to Meigen, it is evidently a species belonging to the genus *Sciara;* but Latreille calls it *Molobrus.*

Meigen reckons thirty species of *Sciara*, sixteen with brown, and twelve with yellow or pale wings, and two the colour of which is unknown. The one mentioned here has indeed brown wings, and thus belongs to Meigen's first division, though it does not agree with any of the species which he has described. It is therefore a peculiar species, which I have taken upon me to call *Sciara pyri*, or the small pear midge, on account of the place of its birth, and because a larger one follows. This small pear midge has club-shaped halteres, the club dark-brown, and the stem whitish. When alive the abdomen is of a lead-colour, with black wings. The head and thorax are black, as are also the antennæ; the palpi are of a pale yellow, the feet whitish, and the tarsi black. The veining of the wings is the same as in the other species of *Molobrus.* From this description it is evident that Meigen did not know this species. In the year 1832, in the middle of July, the first small pear midge made its appearance; but probably the hot weather, which we had in the beginning of July in that year, very much hastened its development. As I now knew these pear-destroying midges, I could bestow sufficient attention on them in the spring of 1832 to search out the rest of their economy. I found the perfect insect several times in spring on the not yet expanded pear blossoms; but during the time of depositing the eggs I could never find the females, whatever trouble I gave myself. The midge is indeed so small, as to be very easily overlooked, particularly when it betakes itself to blossoms that are somewhat elevated, in order to deposit its eggs. Notwithstanding this, it is certain that the small pear midge lays her eggs in the blossoms when they are still closed; because the eggs, or at least the hatched larvæ, would be immediately withered up, if she were to lay them on the receptacle of the open blossom exposed to the sun's rays. This is evident, as the midges are only found on the blossoms in fine days. As I have before observed, I never found them about the time of laying their eggs, therefore I cannot say how many they lay at once. It is probable, however, that they do not lay more in one pear than ten eggs, as I never found more than ten even of the smallest larvæ in one pear.

In the middle of July, 1832, a new species of midge appeared in the glass which I had again filled with pears attacked by larvæ. It belongs, from all appearances, to the same genus of *Sciara*, or *Molobrus*. The female is little more than a line long, and half a line thick, also much larger than the smaller pear midge; the male is more slender, and somewhat shorter. The antennæ are blackish, and not so long as the body. The head is black and shining, as is also the thorax, the proboscis ash-grey, the abdomen of the male a deep black, that of the female browner, with black rings, the anal point, however, quite black. The feet are ash-grey, the tarsi and wings black.

It is evident from this description that Meigen did not introduce this species among his *Molobri*, because it does not agree with any of them. As it is larger than the pear midge already mentioned, and being likewise a devastator of pears, I called it the larger pear midge, *Sciara pyri major* (*Sciara Schmidbergeri*). In August, more than a hundred of these midges appeared in my glasses. As I did not observe this midge early enough in the spring of 1832 to discover all its economy, I can say little of it, except that it appeared to me to resemble that of the black gall-midge, which I shall now proceed to give some account of. [Schmidberger.]

THE BLACK GALL-MIDGE. *Cecidomyia nigra*, Meig.

In 1831, when I examined the glass in which I had kept my pear-midges, to see what had become of the other larvæ that had concealed themselves in the earth, I found several of them changed into the pupa state. These pupæ, in some respects, resembled those of some kinds of butterflies; their antennæ and feet, however, lay outwardly over the body, veiled in a yellow sheath, and the other parts of the pupæ were of a dark yellow.

On the 28th of December 1831, the first perfect insect made its appearance under the gauze in my glass; being a somewhat larger midge than those already mentioned, and afterwards some came out almost daily in the other glasses, so that, by the 15th of February 1832, more than a hundred had appeared. The females, which are larger than the males, are something more than a quarter of a line long, and more than half a line thick. The antennæ are straight, and formed like a chain of beads; in the female they consist of three-and-twenty or four-and-twenty articulations in the male, of about eleven or twelve, but these articulations, though so few in number, being placed wide apart, the antennæ of the male are very nearly as long as those of the female. The abdomen consists of eight rings, that of the male is cylindrical, and furnished at the end with a clavate pair of forceps. The abdomen of the female is pointed, and furnished with an ovipositor consisting of several parts, which draw out and in, like a telescope. The wings are hairy on the flat surface, they have three veins, and on the hind edge a long fringe. It may be seen from this description that this midge is a *Cecidomyia*. Meigen calls it the gall-midge, because, as he says, most of the larvæ live within gall-like excrescences on plants, from which, however, the one in question is an exception.

Meigen enumerates twenty-two species of gall-midges, amongst which those found by me in the pears are evidently the *Cecidomyia nigra;* because the description which Meigen gives of the black gall-midge completely agrees with them. The thorax is black, varying to ash-grey backwards, with black lines on the back, the scutellum is greyish, the metathorax and abdomen blackish, the latter with yellow incisions. The third longitudinal nerve of the wing is softened off, the feet are of a pale grey, and the antennæ are blackish brown. The ovipositor of the female is of a dirty yellow, and as long as the abdomen. I retain Meigen's name and call it the black gall-midge, although it carries on its evil practices on the pear-trees.

In order to ascertain when the midges hatched in the glasses paired, from time to time I left males and females, which had been newly produced, undisturbed together, and I gave them honey and fruit and water in the glass to eat when they required it, but they neither took nourishment nor paired, and died a few days after.

I examined the females, and found not the smallest trace of eggs in their bodies. Those died also that I allowed to fly on the chamber window, although at first they were full of activity.

In the spring of 1832, my first business was to look all round the garden for these midges. When the blossom buds of the pear-tree were so far developed that in the single blossoms a petal showed itself between the segments of the calyx, I found the first gall-midge in the act of laying its egg in the blossom; this was on the 12th of April. It had fixed itself almost perpendicularly in the middle of a single blossom, and having pierced the petal through with its long ovipositor, it laid its eggs on the anther of the still closed blossom. The female was about seven and a half minutes laying her eggs. When she had flown away, I cut the pierced bud in two, and found the eggs lying in a heap one upon another on the anthers. They were white, longish, on one side pointed and transparent, and from ten to twelve in number. I afterwards found several midges engaged in laying their eggs, as late as the 18th of April, from which day they ceased to appear in the garden. I also saw a gall-midge on the side of the blossom with its ovipositor inserted in it; so that they do not merely pierce the petals but the calyx also. I even saw one which, having been somewhat long in laying its eggs, could not draw out the ovipositor from the blossom; the cause of which I conceived to be, that the wound had begun to close during the operation and the ovipositor was thereby jammed in.

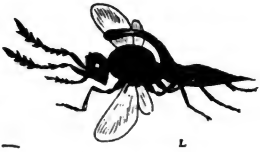
The number of eggs which these midges lay in a pear appears to be various; as I sometimes found only a few larvæ in one pear, and sometimes more than twenty. The eggs are hatched in a short time, particularly if the weather be warm; because on the fourth day from their deposition, I found the small larvæ on the embryo of the blossom, into which they began to bore, usually in or near the stem of the calyx. Before the blossom is expanded they descend to the core, so that they may not be exposed to the sun's rays; which, as has been already said, would endanger their existence. They separate at the core and begin to devour on all sides. When they have consumed the pulp of the small fruit, they have attained their full size, and only wait for a favourable opportunity to leave their still secure dwelling and feeding house. This opportunity presents itself after the first rain; because the little pears being hollowed out, begin to decay here and there and become cracked, by which means an opening is afforded to the larvæ to make their way out. As soon as they get on the surface of the little pear, they bend themselves together and make a spring to the ground to bury themselves. That these larvæ are not injured by such a dash on the ground I am perfectly convinced. I let a larva fall from a height of nine feet on the floor of a room three times running; I then laid it on the earth in a glass, and in a few seconds it buried itself.

If no rain happens at the time they have attained their full size, they sometimes gnaw an opening through the skin of the little pear; they usually, however, remain together in the core till the pear falls off and is bruised by its fall on the ground, when they obtain an outlet. They often remain a long time in the pear on the ground, if they cannot obtain a passage out. I gathered some pears that were outwardly not injured by them, and laid some of them on a board in the room, and others on the damp earth in the glass; and I found the larvæ still in the pears in the middle of July, although they were externally completely withered or decayed, and covered with mould. I took them out of the pear and laid them on the earth in the glass, and most of them, even in July, buried themselves there.

In the year 1831, the larvæ of the gall and pear-midges had attained their full size from the 14th to the 20th of May; but in 1832, not till from the 20th to the 26th, because the coldness of the weather that spring greatly retarded the growth of the fruit. They have, therefore, generally nearly four or five weeks to grow and attain their full size before they bury themselves in the earth, where they await their transformation. As my gall-midges did not appear in the perfect state till December and January, it may almost with certainty be conjectured that the midges issue from the earth in spring to propagate their species in the open air. The small and large pear-midges, on the contrary, which made their appearance in the glasses in July and August, will also appear in the open air at that time; and if they have not a second generation, they will pass the winter in a place of safety.

We shall afterwards treat of the method of keeping off, or destroying this midge, as the same means are to be employed against all the insects destructive to the pear. [Schmidberger.]

The Paradoxical Pear-Platygaster.[*] *Psilus Boscii.*[†]



PSILUS BOSCII.

On the 23rd of December 1831, a very small *Hymenopterous* insect appeared under the gauze in one of my glasses, and afterwards one or more came out every day, so that by the middle of January more than twenty of these insects had appeared out of earth in the glasses. This insect is scarcely a line long; its antennæ are elbowed and have eight articulations: the first is thick and long, the second as large as the last five, the third somewhat longer than the second, and the last five are moniliform. The horny-saws, the head, the thorax, and the abdomen, are black. The latter is very pointed, the fore-part smooth and shining, and the hinder-part is four-ringed. The female has no visible ovipositor, and it only presses a very short one out of the extreme point of its body when it lays its eggs. The wings are whitish, without veins or marginal ribs, the feet black, and the hind-feet much longer than the fore-feet. The thighs are thick, clubbed, and brownish towards the basal part, the other parts are black; the tibiæ are club-formed, and somewhat brownish towards the tarsi. The form of the body, and appearance of the wings, have some resemblance to the figure of the *Psilus* in Panzer's *Fauna*, and also with his *Tiphia cenoptera;* but the insect which came out in the glass is particularly distinguished from all the *Hymenoptera* I have seen, or have seen representations of, because the female has not the vagina in the abdomen, but in a cylindrical curved beam, or horn if I may so call it, bent over the back to the head, which proceeds out of the peduncle, by which the thorax is united to the abdomen, being quite near to the thorax. This horn, like the other parts of the body, is black, its point is thick, and it has an opening. When cut off, it is found to be hollow within like a cylinder. The horn generally lies close to the back, particularly when the insect runs; but when it lays its eggs the horn is raised somewhat in a perpendicular direction, so that you may see

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[*] This interesting insect should by rights have immediately followed the saw-flies, because it likewise belongs to the order *Hymenoptera*; since, however, M. Schmidberger has found the economy of pear-midges and gall-midges so similar, and has treated of the methods of destruction to be used for these pear-devastating insects in the same manner, I thought myself permitted rather to make a small deviation in the system, than to separate insects widely which in many respects so much resemble each other.—*Kollar.*

[†] The paradoxical pear-fly is evidently, from the observations of M. Schmidberger, identical with the ***Psilus Boscii*** of Turine, ***Platygaster Boscii*** of Latreille, and ***Inostemma Boscii*** of Haliday. As regards the peculiar structure and situation of the sexual organs, it is to be observed that if Schmidberger be correct in his observations we have in this minute insect a complete anomaly. The male organs of generation, according to M. Schmidberger, being placed on the underside of the thorax, and those of the female at the extremity of the horn arising from the base of the abdomen and curved over the head. In no male insect hitherto discovered have the organs of generation been found elsewhere than in the abdomen. That the singular recurved horn of the female is not the sheath of the ovipositor, as supposed by Le Clerc de Laval, is decidedly proved by the observation of Schmidberger, that the female thrusts the *extremity of the abdomen* into the flowers in order to deposit her eggs. The observations of Dr. Nees von Esenbeck are also quite at variance with those of Schmidberger, he says: "Qui usus sit processus tam insignis ab abdomine assurgentis difficile dictu. *Solidus* enim est atque continuus neque propria vi usquam movendus *nec pungit* multoque minus terebræ vagina a me

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inventa, quid quidem, ut in reliquis omnibus, *analis* et tota recondita." Moreover, I cannot but fear that Schmidberger has fallen into some mistake relative to the habits of this paradoxical fly. The family, so far as is hitherto known, is parasitical upon other insects, in the same manner as the Ichneumon flies, and indeed Mr. Kirby has shown that one of the species of *Platygaster* is parasitic upon the corn-midge (*Cecidomyia tritici,*) belonging to the same genus as the gall-midge here described. Hence, as Schmidberger describes the larvæ which he found in the buds attacked by the female paradoxical fly, as being exactly similar to those of the gall-midge, and as having the same two black spots in the head, I have very little doubt that it was within the bodies of these larvæ, which were those of the *Cecidomyia*, that the paradoxical fly had deposited its eggs. [J. O. W.]

between it and the back of the insect. The horn, however, has not a joint at its base, and therefore can never be thrown backwards. The male has the parts of generation before on the breast, between the fore and hind-feet, and therefore it has no such horn; it is somewhat weaker than the female, and has a thinner peduncle and abdomen.

In the spring of 1832, I was very eager to see this fly in the open air, in order to make observations upon it. I was very soon gratified; as on the 12th of April the first made its appearance, and on the same day I also saw the first gall-midge on the blossoms. I found the pear-fly just as it was pushing the extreme point of its body into a still completely closed pear blossom. More and more of them made their appearance every day; I sometimes saw them flying from one blossom to another, and sometimes resting quietly with the extreme point of their bodies in the blossom: I then began to examine if they were laying their eggs when I saw them on the blossoms, and how many they laid. Some eggs were within the blossoms, and indeed on or between the anthers, yet never more at most than seven. They were white, obtuse at one end, and pointed at the other, exactly resembling the eggs of the leaping Eulophus, which De Geer has described in his *Treatise on the History of Insects*, vol. ii. second part, p. 195, and figured, t. 31. *fig.* 4.* The eggs of the paradoxical pear-fly must like those of the Eulophus be covered with a gummy humidity, because they remain attached to the anthers and pistil. They bear a great resemblance to the eggs of the black gall-midge, at least I could hardly discover any decided difference between them; they only appeared to me to be somewhat smaller and somewhat thicker at one end. I found them always placed in the same way in more than thirty blossoms, which I examined every time that the pear-fly had withdrawn the point of her body from the blossom and had flown away. I then marked some blossoms on which the pear-flies had, to all appearance, laid their eggs, and I examined the newly set pears a few days afterwards, when the petals had fallen off; I found the young larvæ there already distributed in the core, which was consumed by them. They were white, ten-ringed, and had black dots close together on the head, exactly like the larvæ of the gall-midge.

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* This figure represents the pupæ and not the eggs of the Eulophus, the latter not being figured by De Geer.

In the end of May 1832, the greater number of the larvæ in the pears were fully formed. I therefore again put pears pierced by these insects into glasses half filled with earth. When I cut the pears to pieces, the larvæ within immediately, as usual, retired into the earth.

I found the larvæ in the pears exactly like each other, but they were of different sizes, and the number in each pear was also different; some containing from three to ten, and others from ten to twenty and upwards.

It is difficult to find a method of destroying these pear-flies and midges. The paradoxical fly allows itself to be caught on the blossoms without trouble, but on account of its smallness, like the smaller pear-midge it is easily overlooked. The larger pear-midge and the black gall-midge are on the contrary difficult to catch. The number of these insects is only to be lessened by finding out those pears that are infested by the larvæ and conveying them out of the garden. Such pears are easily known, because their growth far exceeds that of the other pears, and they have attained a considerable size when the petals have scarcely fallen off. When this is seen, you may be sure that one sort of larvæ or another is to be found in the core.

When a pear thus infested is permitted to grow, it increases in size for some time, loses its roundness and bright green colour, and becomes longer and as if pressed inwards all round the middle part. This is the period when the larvæ begin to attain their full size, and therefore the best time for taking them from the tree; for if rainy weather ensue, as already observed, cracks are formed in the pears, by which the larvæ find a convenient outlet, to precipitate themselves to the ground. It is seldom that the larvæ are found in the core of those pears lying on the ground, if the rainy weather is of long continuance; and when that is the case, most of the pears remain on the tree till they are almost completely rotten. If the weather be dry, they usually fall off sooner; and in that case those pears that are lying on the ground should be picked up, or trodden to pieces, particularly if they have no cracks in them; because when in that state the larvæ often remain long in them.

In 1831, having taken many hundreds of pears containing larvæ from the trees, and destroyed them, these insects were in consequence much fewer in number the following year, and the crop of pears much more abundant. I have found fruit pierced by this insect on the best pear-trees and even on the coarse, rough kinds used for making perry; but they are usually found on the dwarf trees, on which fine sorts grow, and particularly the St. Germain; and it is easy to remove the injured fruit from dwarf-trees. I have never observed these insects to attack apple-trees.

These insects have their natural enemies, which feed upon and destroy them. This is particularly the case with the larvæ of the black gall-midge, as I have learned with certainty from circumstances. Exactly on the same day as the first gall-midge made its appearance, which was on the 23d of December 1831, I found several gold shining Hymenopterous insects in the glasses, and every day one or more of the latter appeared under the gauze. These insects were nearly a line long, with the whole body of a gold-green colour. The antennæ had eight articulations, and were black, the first joint being the longest, and yellow near the point, the second somewhat longer than the others, and nearly the same length as the last, which was pointed; the other joints were moniliform and hairy. The horny jaws and the palpi were yellow, also the feet, the thighs however of the hinder feet were partly gold-green, and partly brown, and the ungues blackish. The ovipositor of the female was of a copper-colour, projecting, and somewhat shorter than the abdomen, the eyes were black, and also the three ocelli on the back of the head. The wings were white, finely dotted, without veins, the sub-costal vein only being strong, black and hairy; from it, however, runs towards the centre a shorter, blacker line, which terminates in a thick black spot, so that the whole of this nerve has somewhat the appearance of the halteres of a fly. The lower wings have not these costal nerves, there is only in the middle of the costa a toothlike brownish spot.

As it may be seen from this description, this insect has a great resemblance to the figure of the gold-shining gall-parasite, (*Cynips aurata*) figured in Panzer's *Insecten Fauna*, particularly with respect to the marks on its wings, in which the two kinds perfectly coincide. But as the *Cynips aurata* is much larger, of a different colour, and with the abdomen somewhat differently formed, it cannot be the insect described by me; though it appears to belong to the same genus; and as Panzer in the critical review of his *Insecten Fauna* no longer calls this insect a Cynips, but classes it with the midge parasites (*Diplolepis*), I have called mine *Diplolepis Cecidomyiæ* (the pear-midge parasite), because I have reason to believe that it prefers piercing the larvæ of the black gall-midge to any others.

I shall retain this name till an experienced entomologist appears, who will reduce the Hymenoptera to a system, and describe them as well as Meigen has done the diptera and Lepidoptera and Gravenhorst the Ichneumonidæ. If we had such a work on the hymenoptera, no one need be afraid of deciding upon the genus and species of any hymenopterous insect he might meet with.

This pear-midge parasite, or at least its generic name, would of course be enumerated there, because it is not unfrequently met with, although, on account of the smallness of its size, it is easily overlooked. Should however an entomologist produce such a book, he should by no means omit to add some figures of insects; at least one species of a genus is very desirable, and for a beginner is quite necessary. It is in this respect that Meigen's work on the Diptera is so valuable. If Gravenhorst had only given one table of the veins on the wings, and a few of the subgenera of the ichneumonidæ that are difficult to distinguish from each other, his valuable work would have been it is true a trifle dearer, but the names of the species of ichneumonidæ would have been much easier found.

That this parasite is the destroyer of the larvæ of the black gall-midge, I submit for the following reasons:* 1st. These parasites appeared in the glasses, out of the earth contained in them, from which the black gall-midge also appeared; 2nd. They are seen in spring on the pear-trees the blossoms of which have been pierced by the gall-midge; as I saw them only a few days afterwards, when the eggs of the gall-midge were already hatched, and the larvæ in the core; 3rd. I consider this parasite truly, and also according to Fabricius, as a Diplolepis, perhaps the *Diplolepis nigricornis* described by him, as the description agrees with it in every respect except size, which Fabricius in his description of the insect unfortunately omitted. Although I have seen the gall-midge parasite on the pear-trees in the end of April, I did not think it possible that it could lay its eggs in the eggs of the black gall-midge; because I did not know how it could insinuate its eggs there. Besides, the larvæ of the parasite are too large for them to find sufficient nourishment in the small eggs of the gall-midge; and when their own larvæ have attained their full size, they must be nearly as large as the larvæ of that insect. It may therefore be admitted that the parasites deposit their eggs not in the eggs, but in the larvæ of the gall-midge, and that only when the latter is fully formed and ready for transformation in the earth. They find then sufficient opportunity to insinuate their eggs. The cracks which the rain occasions in the pear are often so large that the parasite can penetrate into the core at pleasure, to lay its eggs in the larvæ. They can also attain this object as easily when the larvæ crawl out of the core; in doing which they are often several minutes in reaching the surface of the pear. I myself saw two larvæ in the act of exerting themselves to make their exit through a crack in the pear, and observed that they were obliged to labour a long time to get their whole bodies out. Even in the earth on which the larvæ have fallen, they are liable to be attacked by the parasites, and to be infested by the deadly egg. I never could ascertain how the parasite lays its eggs in the larvæ, yet perhaps in time I may be so fortunate as to ascertain that which at present I can only represent as probable.

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* It is unquestionable that this insect, which belongs to the genus Callimome of Spinola, Torymus of Dalman, or Misocampus of Latreille, is a parasite in its larva state within the bodies of the larvæ of the gall-midge in question. The instinct by which the parent fly is able to attain a knowledge of the situation where the prey of her offspring is lodged, and then to pierce it, is exceedingly interesting; but not more remarkable than that which induces some of the long-tailed ichneumon flies to bore through apparently solid wood with great fatigue (as I have observed) for the purpose of lodging their eggs in a wood-boring larva.

That this parasite only lays one egg in a larva is undoubtedly a correct opinion; because more than one parasite in one larva of the midge would have too little nourishment to enable it to attain its full size. Besides, it is always the case with ichneumonidæ that they only lay one egg in each larva or pupa; unless they are much smaller themselves than the larva or pupa they have pierced.

The state of the weather has also a great influence on the increase or decrease of all pear-destroying insects. As fine weather at the time of blossoming is uncommonly favourable for laying their eggs, so are rain and strong winds injurious to them; particularly when the expanding of the blossom-buds goes on uninterruptedly; because when this is the case, the flowers attain their full size, and become expanded, before the insects can return to deposit their eggs in them. On rainy and windy days I neither saw the black gall-midge nor the paradoxical pear-fly occupied laying their eggs. The greatest discomfiture they suffer is, when frost sets in and destroys all the blossoms, and newly-set fruit, as this destroys the food of their offspring. Thus, although by this accident we lose all our pear-crop for one season, yet in consequence of it, we are freed from our troublesome guests for a long time, and are therefore indemnified by plentiful crops in after years. [Schmidberger.]

GENERAL OBSERVATIONS.

The following mode of destroying the insects injurious to fruit trees, communicated to me by M. Scheffer of Mödling, is so simple and yet so efficacious, that I cannot do better than lay it before my readers.

M. Scheffer lays loosely rolled-up pieces of old cloth or blotting-paper in the forks of his trees. The caterpillars eat during the night, and while the dew is on the leaves in the morning, but they seek protection from the heat of the day, and creep into these rolls for that purpose. Thus it is only in the middle of the day that these rolls should be examined, and the caterpillars concealed in them destroyed.

IV.—INSECTS WHICH ARE DESTRUCTIVE TO WOODS AND FORESTS.

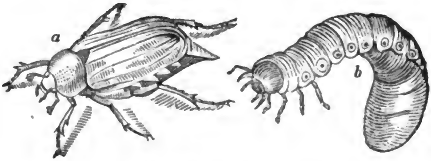
For the sake of perspicuity, we shall divide the insects destructive to forest trees into two principal classes: *viz.* those which attack broad-leaved deciduous trees, or narrow-leaved trees; and those which attack evergreens, particularly those of the first tribe, because but few insects use both kinds for their food. In the first division those insects will be included that are destructive to those trees which indeed, strictly speaking, are not forest trees, such as the poplar, willow, &c.; but which are more suitably enumerated here than with the fruit-trees.

We have to thank the Royal Forest Ranger, the Baron Binder von Kriegelstein, for his numerous valuable observations and remarks on the different kinds of insects here described; and may here observe that this gentleman not only pays particular attention himself to this branch of science, but also, by his encouragement, induces practical foresters to take an active participation in it.*

A.—INSECTS DESTRUCTIVE TO DECIDUOUS TREES.

THE COCK-CHAFER, OR MAY-BUG. *Melolontha vulgaris*, Fabr.

The cock-chafer, also called the may-bug, is too generally known to make it necessary to give a full description of the perfect insect. It is found in spring, generally in the month of May, and sometimes even in April, on most of the deciduous trees; particularly the oak, and willow, and on the hazel and other fruit-trees; and often in such numbers that the branches bend under their weight. The insects pass the greater part of the day sitting on the branches,



MELOLONTHA VULGARIS.
a perfect insect; *b* larva.

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* Since the publication and translation of the original edition of this work, Dr. Ratzeburg has published the first volume of a very extensive and valuable work under the title of *Die Forst Insecten* (Berlin, 1837, 4to. 202 pages and 21 plates.) This first volume is confined to the beetles, which are treated upon in a systematic manner, and not according to the nature of their injuries, or the species of trees attacked. The history of the different species is given at great length, illustrated with numerous beautifully executed figures illustrating the insects in all their states, with representations of the injurious nature of their attacks.

The reader will also find the various species of insects peculiar to the different genera of trees enumerated at considerable length in a series of communications made by me to Mr. Loudon's *Arboretum Britannicum.*

and also on the blossoms and under-sides of the leaves, immoveable, and as if torpid; they seldom fly if the weather is warm and dry, but as soon as evening approaches they begin to buz about, and continue on the wing till towards midnight.

The duration of the life of this insect as a beetle is very short; an individual scarcely lives a week, and the whole brood, in fact, is only seen one month. A short time after leaving the earth, pairing takes place, after which the male dies.

The female buries herself about six inches deep in the earth, and by degrees lays from 84 to 90 eggs in a heap in a passage formed in the disturbed earth; they are of a pale yellow colour, and a longish round shape; she then again makes her appearance, feeds for a short time, and dies, having accomplished the object of her existence. Fourteen days after the mother has laid her eggs, the embryos having become ripe in this period, burst through and quit the shells in the form of worms of a line long. After the space of a year, the size of the body has increased so much, that the insect is half an inch long, and about the thickness of a quill. Its food consists of the tender roots of different kinds of plants. In the second year the larvæ or grubs are already an inch long, and about as thick as a child's finger; in the third year one and a half inches long, and the thickness of a man's finger. The forepart of the body is of a yellowish white with grey wrinkles, the abdomen of a violet colour from the excrement shining through it, and the head and feet of a yellow red.

After this time the transformation to the pupa state follows. The insects change their skins only once a year, and in order to be able to await undisturbed for that period, each grub lives in a hard narrow hole of an oval shape; which it forms by turning itself round a great many times, and which it lines with the saliva which flows from its mouth, so that this smooth and hard covering may protect it. The larva, after changing its skin again, leaves its abode to search after roots. When winter comes on, particularly when the surface of the ground begins to freeze, it goes deeper into the earth, and there remains without food in a torpid state, from which it only awakes towards spring. When the grub has attained its full size, it buries itself in the ground, five or six feet deep, at the beginning of the fourth year, prepares itself a dwelling similar to the one it occupied when changing its skin, previously discharges its excrement, and quietly awaits its last metamorphosis. It now soon begins to swell out, becomes shorter, and thicker, the skin bursts behind the head, the slit gradually becomes wider on both sides, and the skin by some vermicular movements is disengaged from the pupa, which now appears of a pure white, and as the first representation of the beetle, all its parts being now recognizable. As it advances towards maturity, the pure white colour changes to a dirty orange yellow, which gradually grows darker. In January, or at the latest February of the fifth year, the cockchafer assumes its mature form. It leaves the pupa case a soft and white beetle at first, but in the course of ten or twelve days all the parts of its body become hard, and of their proper colour. The insect now remains three or four months in the earth, approaching however gradually nearer to the surface; till May, or in the middle of April, if the weather should be fine, when it exchanges its abode in the earth for one in the air. The complete transformation of a May-bug, therefore, occupies a space of five years, or even in case the beetle be retarded in its transformation by its food and the weather, sometimes six years.

The May-bug is an exception to most other insects, (as may be seen from the foregoing pages) as it is able to do mischief in a double form:—*viz.* as larva and beetle, in seasons when its increase exceeds the proper limits. The larvæ spare neither meadows nor cornfields; they often destroy potatoes and other vegetables, and even gnaw the roots of trees and vines, so as to make them sickly. They do particular injury in nurseries, where seeds are raised, to the young plants. By attentively observing the appearance of the young trees, the presence of the larvæ of the May-bug gnawing at the roots can be detected. The plants thus deprived of their roots become yellow and parched, and are easily taken out of the ground. Young fir-trees are not less exposed to the attacks of this insect than deciduous trees. These insects must not be looked for under the already parched up trees, but under those that are in the act of withering; as the former are already deserted from want of nourishment. The fully formed beetle is still more destructive than the larva. It attacks cherry, apple, pear and nut trees, the vine, the oak, and the beech, &c., in multitudes. The leaves and fruit of the trees, when this is the case, are completely destroyed; and the stems, full of sap, become unhealthy, and either recover slowly, or die off. It is worthy of remark, that these insects spare the lime-tree. It is natural that the agriculturist, gardener, and forester should try to discover a method by which so powerful an enemy in their peculiar province, may be lessened in number or destroyed. The description we have given of its manner of life, and place of abode, will show how difficult and even impossible it is to destroy this insect. It is impossible to search for the small eggs in the earth; and to dig up the grubs that live deep in the ground would be attended with an expense which would far exceed that of the ravages they commit, while collecting those which are thrown up by the plough and the spade is not to be taken into consideration. Nothing remains to be done, but to catch the fully-formed beetle. Nature, however, as in all other extreme visitations, has provided a more effectual remedy for this evil than can be devised by man. Pigs, moles, field-mice, a multitude of birds (particularly the crow, raven, jackdaw, the woodpecker, and the hawk), and even the large ground-beetles, *(Carabidæ)* instinctively search out the May-bug and its larvæ to feed on. Unfavourable weather often comes on, and if the month of May is wet and cold, the success of the May-bug is at an end; but in order to aid in lessening their too great increase, country magistrates and managers of forests should issue a strict order every spring to the farmers, gardeners, and labourers, to search for and collect these insects as soon as they appear in the gardens, hedges and forests. For this purpose the children of the peasantry in the country, and those of the lower classes in towns, should be employed and encouraged by rewards. This business should take place in the morning, because the May-bugs which may have been sitting on the blossoms of the trees during the night have become as if torpid, and as long as the branches remain still they do not cling tightly to them with their hooks; in this state they can easily be thrown down in heaps. In shaking the trees care should be taken that there are no nails or iron on the soles or heels of the shoes of the boys who climb up the branches, so that the abundant sap and tender bark of the trees may not be injured. In order to facilitate the collecting of the fallen beetles, a linen cloth should be spread under each tree, otherwise they will crawl away in the grass. This practice should be continued throughout May and even to the beginning of June. The collected insects may be killed by pouring boiling water over them, and given as food to fowls and swine; or they may be burnt. It is not advisable either to bury them or to throw them into ponds or rivers, because they would make their way out again, and commit new ravages. Nurseries are best protected by leaves being strewed over the surface of the ground, because (as it is asserted) the beetle never lays its eggs in ground covered with litter.

Another method of setting a limit to the too great increase of the cockchafer consists in sparing those birds before-named which feed on them, and amongst them the crow undoubtedly claims the first place. These birds follow the plough for the express purpose of consuming worms, the larvæ of insects, and particularly those of the cockchafer, which are thrown on the surface by the plough. The instinct of the crow to go in quest of this grub, may also be observed in gardens and other places where vegetables are planted. It walks about between the plants, and as soon as it sees one that has begun to wither, it approaches it with a joyful spring, digs with its sharp bill deep into the ground near the plant, and knows so well how to seize its prey, that it draws it forth and swallows it almost in the same moment. The crows do the same in meadows, which we sometimes see completely covered with them.

Amongst the smaller mammalia the mole particularly pursues the grub of the May-bug, and the larvæ of many other insects which live in the ground, and it should certainly be spared more than is usually the case. As a protection of meadows from the devastation of this grub, plentiful watering is recommended; covering the meadows with harder earth, such as marl, road-scrapings, &c.; and an alternation of manure composed of animal dung, and that of corrosive substances, such as gypsum, saline matters, &c.; by which latter method the grubs are killed, or at least are obliged to bury themselves so deep in the earth that they can no longer injure the roots of the plants.

The existence of the may-bug is certainly not maintained merely as a detriment to meadows, fields, and trees; for who knows whether the injury which we many years sustain from its presence, would not be greatly increased by its entire destruction, if that were possible? Besides that they serve many other creatures for food, these grubs so loosen the meadow earth which the plough never approaches, that the rain easily penetrates into it. Neither do they merely devour the roots of useful plants, but those of weeds likewise; and by this means prevent the superabundance of many species which are injurious. In modern times, an oil, which can be used as grease for carts, has been made from the perfect insect, in the following manner.

When the cockchafers are swarming in any place, people should be sent into the apple-orchards, oak-woods, vineyards, or plum-orchards, with vessels that will contain about eight quarts, to collect the beetles in them; and these vessels should be stopped up with straw as soon as they are filled. The most convenient place should then be chosen on a sloping hill or elevation towards the south, in which as many holes or spaces should be hollowed out, as there are vessels; these vessels are then to be turned downwards over the holes, and so adjusted that another vessel of the same size at the mouth, empty and clean, can be pushed under the first. Then the turned-down vessel, filled with cockchafers, is surrounded with a fire of chips, sawdust, shavings, or brushwood, which occasions a quantity of fat or oil to drop down from the vessel containing the cockchafers through the straw into the empty vessel below.*

THE PROCESSIONARY MOTH. *(Bombyx gastropacha) processionea*, Autor. (*Cnethocampa processionea*, Stephens.)

Amongst the most destructive enemies of deciduous trees, particularly the oak, is to be placed the processionary caterpillar, as it is called in the larva state. In many seasons we see a white line on the stems of the oaks, sometimes moving upwards and sometimes downwards. This is nothing else than the whitish-haired caterpillar, which feeds on the leaves of the oak, and which often so numerously besets trees that whole tracts of forest about the end of May become stunted and withered. These insects have a particular social instinct. From the moment they leave the egg they continually remain together and form large families, until they arrive at the last stage of their lives, when they disperse as moths. The young caterpillars appear towards the end of April or beginning of May. Their first occupation consists in preparing themselves a place of shelter to protect them in their tender state from the influence of the weather. With that intention they lie close together, selecting a situation beneath a branch where it proceeds from the stem, and co-operatively spin a fine silky covering over themselves. They sit under this tent during wet weather; and also during the hot sunshine, and from choice go out in quest of food in the morning, or towards evening. When the first web is too small for the insects that have grown large, they spin a second in a suitable place, and afterwards a third. It is only when they have attained two thirds of their size that they prepare themselves a nest, in which they are always to be found, except when they are out in search of food.

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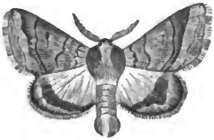
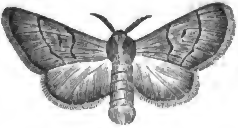
* Besides the true may-bug, there is another very nearly allied species, *Melolontha Hippocastani*, which is sometimes very abundant, and injures not only the horse-chestnut, but all deciduous trees in the same manner. Particular shrubs are also exposed to the attacks of a smaller beetle of the same family, viz: the garden-chafer, *Anisoplia* (*Melolontha*) *horticola*, Fabr., which has already been described as one of the insects destructive to fruit trees. The most effectual remedy for lessening the number of both these kinds is to shake down the beetles and destroy them.—*Kollar*,

It is not often in this country that the cockchafer becomes the source of decided injury to forest trees, although instances are on record in which such has been the case.—(See the article "Melolonthidæ," in *Brit. Cycl. Nat. Hist.*, vol. iii. p. 232.) In addition to the means suggested for their destruction in the text, the burning of weeds, &c. has been adopted both with the view of stupifying those which were amongst the leaves and preventing the approach of others.—*J. O. Westwood.*



MALE.



FEMALE.

BOMBYX PROCESSIONEA.

In the first part of the month of July, the processionary caterpillar is fully grown. It is then nearly an inch long, and of the thickness of a common quill. The head is dark-brown; a dark-brown velvet-looking stripe runs along the back; the sides are a bluish-grey; the belly a yellowish-white; and each ring of its body is furnished with ten yellowish warts, in which are tufts of long and short whitish hairs, which when seen through a magnifying-glass, appear prickly.

The most remarkable circumstance connected with this insect is its regular peregrinations. When the time for its going in quest of food arrives, one caterpillar places itself at the beginning, a second immediately follows, its head touching the tail of the preceding, then a third and fourth, and so on; so that their march resembles an uninterrupted whitish thread, which moves on slowly over the trees. Sometimes a pair of caterpillars follow the second or third caterpillar, and are followed by three, then four, and so on; so that each new row becomes part of the whole, and the march assumes the appearance of a kind of wedge or phalanx. It is only when they arrive among the branches of the trees that they break through this regularity, and each separately selects itself a leaf for food which is the most suitable for the purpose. When they have satisfied their hunger, or are necessitated from unfavourable weather, rain, or heat, they make their retreat in the same remarkable manner, and betake themselves to their nest. If the first tree is stripped of its leaves they leave it, and undertake a longer journey of the same kind to a second. As already mentioned, they spend their time in their nests when they are not in quest of food, which nests vary in form, size, and strength according to the different ages of the caterpillars. The last nest, the fixed abode of the full-grown insects, in which they assume the pupa state and are transformed to moths, has no regular form; it is attached like a purse to the trunk of the oak, sometimes higher and sometimes lower, and often even on one of the highest branches; yet always in such a way that it is protected from gusts of wind and from rain. It consists of several layers of a silky kind of spun material, in which the cast-off skins and the excrement of the caterpillars are interwoven. It has only one opening, which is at the upper end; and its dark-brown colour so much resembles the fungus and excrescences of the oak, that it not unfrequently deceives the enemies of the caterpillar contained within it. There are often from seven hundred to eight hundred caterpillars contained in one nest, and several nests are often found on one tree. From this immense number, and the well-known rapacity of the caterpillar, it is evident that in a very short time whole forests of oak must be stripped of their foliage by them.

The processionary caterpillar indeed prefers the Turkey oak, yet it attacks the other species when it has defoliated the first; and in 1828 I even saw them on the beech and willow trees in great numbers. They assume the pupa state in the first part of the month of July; and this change generally takes place in the nest itself, but sometimes also in the chinks of the oak-bark. The insects remain in the pupa state nearly a month, and appear as moths about the middle of August. The moth is a gray insignificant creature, which is seldom seen, as it only flies by night, and its life is but of short duration. Its larvæ on the contrary are seen in great numbers.

The male and female moths are materially different from each other. The former is smaller, and has light-brown strongly pectinated antennæ; the head and thorax are ash-grey; and the abdomen is brownish, with a dark-brown tuft at the extreme point of the body. The upper wings are ash-gray, and darker clouded, and at the base is an ash-grey wavy cross line; then another line almost straight, in an oblique direction, and a third somewhat wavy with its inner edge inclining towards the second: there is a blackish spot between these two. The under wings are whitish, with a faint black-gray cross stripe. The female is always larger than the male, and of greyish-brown all over the body; her wings are more distended, and the marks upon them are softened off. The antennæ are more slightly pectinated than those of the male, but the anal tuft is much larger. Pairing takes place in the night, immediately after which the female lays from a hundred and fifty to a hundred and eighty eggs, either on the trunk of the oak, or on its branches, but generally on the side of the tree that is exposed to the sun. In this occupation the parent insect displays a care and accuracy almost beyond belief. She first covers the space on which the eggs are to be laid with a strong glue from the anal end of her body; she then strews the under part of her tail-tuft on the glue, so that the delicate hairs form a kind of bed. She then lays her eggs on this bed in rows arranged according to the most beautiful symmetry, and covers them with the remaining part of her tuft. As the covering of the eggs perfectly resembles in colour the oak-bark, it is difficult to be distinguished, and only possible by a very practised eye. Although the processionary caterpillars do not destroy a whole oak-forest at once, as is the case sometimes with other insects and other kinds of trees, yet they are not harmless guests to the forester. They not only eat the leaves of the oak, but also its blossoms, and thereby destroy the acorn crop; which in many places where they are used to feed swine, is of great consequence. Besides, after the caterpillar has disappeared the tree produces leaves the second time, thus exhausting the supply of sap which was intended for the new wood, so that the oak forest in the year in which it is attacked by this caterpillar makes no new wood.

When the processionary caterpillars are over-abundant in a forest, they generally continue their ravages for several years together, until they are destroyed either by the state of the weather, or by their natural enemies, which increase in like proportion. The forester to whom the care of a wood is entrusted, should therefore be particularly attentive in spring, to see if there are any of these caterpillars on the stems and branches of the oaks, and they are easily discovered by their sociable habit of life, and the striking appearance of their nests. The forester should then make the threatening danger known to the proper authorities without delay; in order that decisive measures may be taken to check the evil in the bud. Several warm summers in succession favour the propagation and disproportionate increase of the processionary caterpillars; therefore the forester should carefully examine his oaks in those springs that follow a warm dry summer, in case this caterpillar should be numerous.

From the foregoing history of the processionary caterpillars, the means which the authorities should use, and the time of using them for the extirpation of this pest of the woods, are easily deducible.

In autumn and winter these insects are in the egg; and although it might appear the most suitable time to attack the enemy when it is in a condition in which it must be in a state of inactivity, yet its peculiar situation, that is, the artful manner in which the egg state is placed, does not allow it. The eggs lie in thin flakes on the stems or twigs of the trees, and, on account of their colour, so nearly resemble the bark of the oak, that only a practised eye can discover them.

It is much easier to see the young caterpillars towards the end of April and beginning of May; as they are hatched about this time, and live together in hundreds. A thin web, which they spin over themselves, mostly in the angles where a branch proceeds from the tree, makes them more perceptible. A proportionate number of men should go through the woods on hot days, or during rainy weather, when the insects generally sit closely together, and examine the young oak-trees and bushes carefully, in order to destroy with the hand the caterpillars' nests found on them. During this operation it is however necessary to protect the hand with gloves, or with stuff or linen rags, because the hair of the caterpillar causes a violent inflammation on the skin. A linen rag folded several times can also be used to destroy the nests.

The outskirts of the forests and the thinnest parts of them should be particularly examined; because the caterpillars prefer these places. Isolated oak-trees ought not to be overlooked, but when they are beset by these insects they should be carefully freed of them; because the plague may spread from them over the whole forest. This method of destruction is to be continued as long as the insect remains in the larva state. The larger the insects become, the more easily they may be discovered; either by the traces they leave behind from eating the leaves, or by their large brown nests which hang on the trunks or thick branches of the trees. About this time, that is in June and July, while the caterpillars are in their nests, and during hot or wet weather, they should be carefully taken down and destroyed; but still greater caution is necessary to prevent the hair which is woven in the nests from coming in contact with the skin; because it occasions even more serious consequences than that of the caterpillars themselves, being longer and stiffer. The soft part of this nest must also be particularly avoided; for if the fine hairs of which it is composed come on the face and eyes, they occasion inflammation and insupportable itching. An application of bruised parsley has been recommended as a cure.

The pupa state follows that of the larva. This takes place as already mentioned, in the first part of the month of July; and the insect remains in this state till towards the middle of August. At this time, when the insects are either lying in their nests immoveable, or in the chinks of the bark, the forester should be most assiduous in destroying them. The utmost care must now be taken to collect the nests in boxes or baskets, and to burn them in a suitable place. Should the caterpillars have stripped the oak-forests in the course of the summer, the trees will thus be secured from a similar calamity the next and following years. If the proper time for extirpating the insects be neglected and the work of destruction delayed till towards autumn, all labour is then in vain. The moth appears about the middle of August; and in the night, immediately after leaving the pupa, she lays her eggs; and thus the seeds of a still greater devastation are sown for the following year. The destruction of the caterpillars' nests in autumn and winter is labour in vain, as at those times they are only filled with empty pupa-cases and cast-off skins. Foresters may thus do much directly to protect the oak-woods from their greatest pest; but they will indirectly render them essential service, if they will spare the natural enemies of the processionary caterpillar, or even try to increase them.

Among the principal enemies to all insects may be enumerated in the first place, a great many birds, to which they serve as food; these are the woodpecker, the blackbird, the thrush, the cuckoo and the hoopoe; but particularly the smaller birds of the forest, such as the tomtit and the flycatcher, which not only destroy the insects and their larvæ, but also their eggs. There should therefore be a prohibition issued against the immoderate capturing of such creatures, particularly at the time when they have young ones, because they then convey a great many young caterpillars to their nests. Besides the birds, the processionary caterpillars have multitudes of insects which bear enmity to them. The larva of a tolerably large beetle, *Calosoma inquisitor*, which devours a great many caterpillars and chrysalides, lives in their nests. The full-grown beetle does the same also; it crawls in great numbers up and down the stems of the trees, and snatches many a link from the chain of the travelling caterpillars. The larva of a smaller beetle, *Silpha quadripunctata*, also lives in the nests of these caterpillars and feeds upon them. A great number of field or tree-bugs co-operate no less in destroying these caterpillars, which they effect by piercing them and sucking their juices with their suckers.

The most effective enemies, however, are the small and scarcely visible Ichneumon-flies, of which there are a great number. These insects lay their eggs in the living caterpillars, in which the eggs change to larvæ or maggots which live on their juices. As soon as they are fully grown they bore through the skin of the caterpillar, make an oval cocoon as a pupa case, and come out a fly. We often see a caterpillar sitting motionless on a tree; and on or under it a great many white or yellowish egg-shaped globular bodies; these are nothing else than the cocoons of ichneumon–flies, which the ignorant take and destroy, supposing them to be the eggs of the caterpillar. These cocoons ought neither to be taken from the tree, nor destroyed, because they contain the greatest benefactors to the forests. The caterpillars pierced by them cease to eat, and are therefore not capable of transformation to the perfect state.

If the forester reflect upon what has been said, and will act upon the hints given, my belief is that the processionary caterpillars will never so much increase as to be injurious to the oak-forests.*

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* Fortunately the processionary caterpillar cannot be regarded as an inhabitant of this country; but its economy is so remarkable, and the remedies suggested for its destruction so applicable to some other species of caterpillars, which occasionally occur in great numbers in our forests, that it has not been thought advisable to omit it in this translation.

THE SATIN MOTH. *Bombyx (Liparis) Salicis*, Autor. (*Porthesia Salicis*, Stephens.)

The satin-moth is a very great enemy to the willows, and to all kinds of poplars. The larvæ of this moth appear many years in such great numbers, that they strip all the willows and poplars of their leaves; so that they not only present a very melancholy appearance, but those that are young and weak perish, and particularly so, when the caterpillars are abundant several years in succession.

I have remarked that the destruction of this insect is usually commenced by the foresters when the caterpillars are nearly full-grown, and the fearful injury which they do already finished; I will therefore treat particularly here of the different periods of the life of the moth, and show at which its decrease and destruction can be effected with least waste of time and trouble, as well as with greatest benefit.

The perfect insect appears generally in June, sooner or later according to circumstances, as a shining white moth; its eyes are black, its antennæ brown, more strongly pectinated in the male than in the female, and the feet are black with white rings. Besides the less pectinated antennæ of the female, she is distinguished from the male by a thicker abdomen; and on account of her unwieldiness generally sits quietly on the stems of the trees, or on the leaves, while the male often flies in swarms round the poplars. If it is intended to set a limit to the too great increase of this insect by destroying the moth, unnecessary time should not be spent in catching the males, which are much more numerous in proportion than the females, but search should rather be made for the pregnant females whose abdomens are distended with greenish eggs, and these should be destroyed. The females begin to lay their eggs immediately after pairing, either on the trunk of the tree, or on the leaves; the best thing to be done is to send men at this time to examine the trees, and to kill the female while she is laying her eggs. By searching for, and destroying the eggs, one man can do more than twenty others employed in killing the full-grown caterpillars, which are usually dispersed all over the tree.

Further, it only requires a somewhat practised eye to find out the eggs, if their appearance is once known. If the time is observed when the satin-moths collect together, or immediately after they have collected on the poplar and willow stems, a shining, smooth, white spot will be observed here and there, which at a distance has a great resemblance to a drop of saliva. If this spot be examined closer, it will be found that under a thick white skin lie a number of green round eggs. These spots are found both on the upper and under sides of the leaves.

There is now nothing farther to be done than to take off the leaves covered with eggs, and to cut off the spots from the tree with a knife. The eggs collected in this manner are not to be thrown on the ground, but must either be crushed or burnt, because the young caterpillars are soon hatched, and would then take up their abode on the willow-tree. In this manner one man can examine a whole avenue in one day, and destroy many thousands of eggs. This occupation must take place in the course of the month of July and the beginning of August; because the caterpillars are hatched in about fourteen or twenty days, and then disperse over the tree.

During autumn and winter, they sit singly under a thin web in the cracks of the bark, or under the bark itself. A great deal might be done at this time of the year for lessening the number of caterpillars, if the stems of the trees were rubbed down with straw or hard brushes; but this labour is attended with too much trouble and waste of time. Therefore in spring, after the poplars have put out their buds, their stems should be carefully examined; as the young caterpillars then collect, and sit in heaps where the branches come out from the tree. A ball of moss or tow covered with linen can at one effort destroy a whole brood, particularly in the morning. When they become larger they disperse over the tree, and collecting them by means of ladders is not only very tiresome but also very ineffectual.

Even at this time, however, it is better to do something than nothing.

Where the caterpillar is fully grown it is from one inch to one and a half long; of a black colour, and brownish-gray on the sides; with a row of oval yellow, or white spots, between reddish-yellow hairy worts, running along the back. These caterpillars are transformed into pupæ in a thin whitish web between leaves curled together, and can in that state be collected with little trouble in great numbers and destroyed. The pupa is shining black, furnished with yellow or white tufts of hair. Several birds may be mentioned as the enemies of the satin moth, particularly the tomtit and the flycatcher, which search out the young caterpillars in the rents of the bark.

This caterpillar seems to be less exposed to the attacks of ichneumon-flies than other cocoon-making caterpillars; I saw however small flies searching out and destroying their eggs.

THE BUFF-TIP MOTH. *Bombyx* (*Pygaera*) *bucephala*. Autor.

The caterpillar of one of our most beautiful insects, the buff-tip moth, is one of the few insects which attack the lime, it nevertheless is found on other deciduous trees; such as the oak, beech, birch, alder and willow, and even on rose-trees and fruit-trees. Sometimes these insects appear in such numbers that the tree or shrub they attack is completely stripped of its leaves; as on account of their magnitude they require a great deal of nourishment to enable them to attain their full size.

This caterpillar does not appear till the latter end of June, or the beginning of July, and feeds to the end of September. When fully grown it measures nearly two inches long, and is about as thick as a goosequill. It is thinly haired, dark brown, with interrupted slender yellow longitudinal stripes which are intersected by a yellow crossband between each segment. The dark-brown pupa is furnished with a point at the end of its body and lies flat in the earth without a web, where it passes the winter.

The moth appears in May and June; when it sits, with its wings bent downwards, covering the whole body, so that it resembles a scroll. When its wings are expanded, it measures from two and a half to three inches wide. The antennæ are brown, and the head and thorax ochre-yellow, the latter being surrounded by rusty-brown double lines; the abdomen is pale yellow, spotted with black on the sides. The upper wings are notched, ash-grey, and silver-grey at the base and inner edge; a pale yellow, or silver-grey kidney-shaped spot is placed in the middle between two yellow cross-lines, with rusty-brown edges outwardly, and dark-brown edges inwardly; and towards the tips of the wings there is a large, almost round, dark clouded spot, bounded inwardly by the second cross-band in the form of a half-moon. The under wings are of a yellowish-white; and have, near the inner angle, a greyish-brown, and often faint double stripe. The under side is yellowish-white, darker shaded on the upper wings in the centre, and sometimes with a shortened band of a rusty-brown through the middle.

As the caterpillars, when they appear, are gregarious, they can easily be destroyed by picking them off when young.*

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* Besides the insects just treated of, there are many which are injurious to different kinds of deciduous trees in forests, meadows, avenues, and gardens, which are treated of in their proper places, as well as those that are injurious to fruit-trees; particularly the caterpillars of many moths which are satisfied with almost any kind of deciduous tree; to which belong, for example, the yellow-tail moth, ***Bombyx chrysorrhœa***, the lacquey-moth, ***Bombyx neustria***, the gypsy-moth, ***Bombyx dispar***, the goat-moth, ***Bombyx ligniperda***, the latter of which, as well as the wood-leopard-moth, ***Bombyx æsculi***, live on the wood, and not on the foliage.—*Kollar.*

In our own country the oak occasionally suffers considerably from the ravages of the caterpillars of one of the small species of Tortricidæ (***Tortrix viridana***) a pretty little insect about three quarters of an inch in expanse, with the fore-wings of a fine pale-green colour, except the front margin, which is white. These caterpillars ingeniously curl up the leaves of the oak, fastening them with silken threads, and thus

B.—INSECTS DESTRUCTIVE TO THE PINE AND FIR TRIBE.

INSECTS are injurious to different kinds of the pine and fir,

1st. By eating off the foliage; from which the tree, particularly when much stripped, begins to decline, or dies completely off.

2nd. When they use the young shoots for their dwellings and nourishment, and the tree is thereby, not indeed killed, but retarded in its upright growth.

3rd. When they injure the bark and inner bark, and even penetrate the wood.

4th. When they cut off the roots of the young trees, and thereby cause their death.

The caterpillars of some moths, and the larvæ of some saw-flies, are the only insects which select the foliage of the Scotch pine, *(Pinus sylvestris)* and the Austrian black pine *(Pinus nigricans)* and also the spruce and silver firs, for their food, and when they are unusually abundant they occasion the greatest destruction among these trees.

The most dangerous are the pine-tree lappet-moth, (*Bombyx pini*), the black-arch moth *(Bombyx monacha)*, and the pine-saw-fly *(Tenthredo pini)*.

THE PINE-TREE LAPPET-MOTH.* *Bombyx* (*Gastropacha*) *Pini*, Autor. [*Dendrolimus Pini*, Germ., Curt., Steph.]

This very destructive insect is especially injurious to old pine-trees, and is known by different names in different parts of Germany. The caterpillar of this moth only eats the leaves of the common pine, *Pinus sylvestris*, and the black Austrian pine, *Pinus nigricans*, and obstinately rejects

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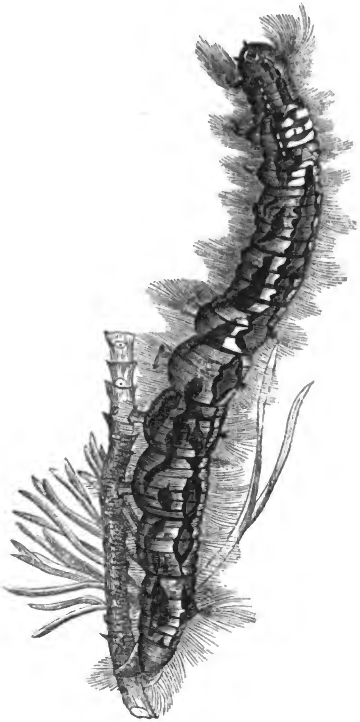
constructing not only an abode, but securing a supply of food. In some seasons they are so numerous as entirely to defoliate oak woods, and upon beating the bushes whole showers of the moths are shook into the air.—*I. O. W.*

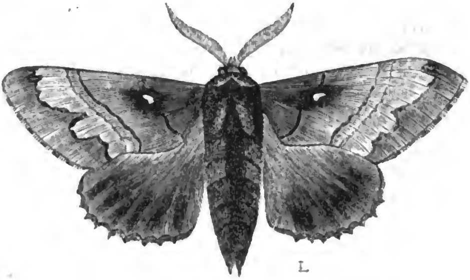
[*] This moth is very rare in this country, not more than two or three specimens having been recorded as captured in England —*Idem.*

other food. It prefers the foliage on old trees on dry sandy soil, it eats however the foliage of trees of younger growth when compelled to do so by necessity. When these insects attack a tree, they entirely consume the leaf and sheath, even to the bark, when the shoots are young, they also eat



CATERPILLAR.

the bark itself; and when they have done with one tree, they go in great numbers to the next. As the caterpillars entirely strip the tree of its leaves, its death is often an inevitable consequence. Those who have been witnesses of the ravages of the great swarms of caterpillars of this moth, cannot sufficiently express the melancholy and lamentable appearance produced on the trees by the injuries they commit; so that with the common bark-beetle and the black-arch moth, the pine lappet-moth may with justice be considered to rank among the most dangerous enemies to the forest.



BOMBYX PINI.

There is no great difference in the colours and markings of these caterpillars; and indeed they have but few unvarying marks common to them all. A fully grown caterpillar measures from three and a half to four inches long. The head is generally ochre-brown, the upper side of the body dark-gray, there are many whitish-gray and brown lozenge-shaped spots, and shortened side stripes, along the back, with long brown tufts of hair, and between these are small hairs scattered about like down; the colour of the hair often varying from ash-gray to fox-red. The two first segments display two bluish stripes when the caterpillar bends its head downwards, which lines, however, are sometimes wanting; a thicker brush kind of tuft of hair stands on an elevation on the last ring of the body. The under side is generally of a dark orange-yellow, with brown spots.

The pupa is an inch long, the front part of the body is dark-gray, and the hind part dark-brown, and reddish-brown in the incisions between the rings of the body. It lies in an oval yellowish, or brownish web, which is woven with the dark hairs of the caterpillar; but there is a hole at one end with a thin web spun over it to form an easy exit for the moth.

When the wings of the moth are extended, it measures from two to three inches broad. The male is smaller than the female, of a more lively colour, and has broader doubly pectinated antennæ, which are brown with whitish combs. The upper wings are grey with broad rusty-brown bands, and there is a rusty-brown patch on the disc, on which is a white spot. In this manner the upper wings are divided across into four parts, the inner and middle ones of which are red-brown, and the two others grey; they are separated from each other, sometimes by many and sometimes by a few notched lines; the white spot, which is always apparent, standing on the limits of the two innermost divisions. The under wings are pale reddish-brown; and the under side of all the wings is brown-grey; but the marks and colour are so changeable, that two specimens can seldom be found alike.

The pine lappet moth appears as a perfect insect in July and August, the female quietly sitting on the bark of the pine during the day, and by degrees laying from one hundred to two hundred eggs, of a longish round shape and of a yellow-green colour, in a roundish flat heap of a tolerable height. In the course of ten or fourteen days the caterpillars are hatched, ascend the tree, and immediately begin to consume the foliage. Late in the autumn they attain the length of an inch, or an inch and a half; the traces of their gluttony can then be observed from the thin appearance of the foliage. When the cold comes on, the caterpillars leave the trees, and creep on the ground under the moss to spend the winter.

there, but not to become pupæ. When warm weather returns, they generally leave their winter quarters in April, again ascend the trees, and continue to eat uninterruptedly from June to July. Then they change their skins for the last time, search out low bushes and trees, and suspend their pupæ, above described, on the bark and the bare twigs, from which the moth proceeds after an interval of fourteen or twenty days.

On an unusual increase of this insect, hatching and transformation are not limited to a particular period, as is the case with most of the forest-destructive insects, but the eggs, caterpillars of every age, and moths, are found at the same time, and often on one tree together, particularly throughout the whole summer; their increase is indeed without number and almost beyond belief. Fortunately several species of ichneumon flies labour in subduing the too great increase of the pine lappet moth, some species of these flies attacking the eggs, and others the caterpillars. M. Bülow Rieth, who has sent us some valuable observations on the pine lappet moth, asserts, (and it has been confirmed by further experience) that an attack of this insect lasts regularly three years, and is then completely stopped by the ichneumons and parasitic flies of the genus *Tachina*, Meig. During the first year of the attack he obtained but very few ichneumons from the eggs, caterpillars, and pupæ of this insect; in the second year he had more; and in the third, the greater number were found pierced by the parasites, so that in the fourth year scarcely a caterpillar could be found, though millions of them were seen only the previous year.

Many birds contribute essentially to diminish the number of these insects, viz.: all kinds of woodpeckers, the jay, the nuthatch, the cuckoo, thrush, blackbird, finch, and titmice. Amongst the quadrupeds, the squirrel deserves to be first mentioned; but the different kinds of mice, as well as wild and tame swine, will search out and devour the caterpillars and pupæ.

The means which can and should be used by man against these insects, consist in methods for guarding against, and destroying them.

The first method consists in having the forests examined every year at the proper season, by a competent person, in order to discover whether there are any traces of the caterpillars, and to see that the proper directions are put in execution for destroying the brood before the insects have become too abundant. Those persons who are much occupied in forests should also make themselves familiar with the economy of this insect; and whether it is found in the larva, pupa, or perfect state as a moth, the proper directions for its destruction should immediately be put in practice.

When the trees are young, the caterpillars should be picked or shaken off and collected, by laying down branches of the pine and fir as traps, to collect them. But when the insects first show themselves in a wood on high strong trees, where they are beyond the reach of being thus destroyed, there should be no delay in cutting down the tree and burning it. This is indeed an extreme remedy, but the only effectual one for securing the other sound trees. As a means of checking the increase of these insects, it is advisable that the pines should be mixed with other trees, particularly with those which are deciduous; and that cattle and other animals should often be admitted into the forests, particularly sheep and pigs.

The methods of destruction are the same as those which have already been recommended for guarding against the ravages of other insects. Above all, the laying of traps is recommended, the traps to be made of twigs of the pine, as the caterpillar is found to undergo its pupa state in the twigs, and can therefore be very easily destroyed. A method which has succeeded the best in every attack of caterpillars.

THE BLACK ARCH MOTH. *Bombyx* (*Liparis*) *monacha*, Autor. (*Psilura monacha*, Steph.)

The caterpillar of this moth feeds on deciduous trees as well as those of the pine and fir tribe; amongst the former, it attacks oaks, elms, aspens, limes, willows, and even fruit-trees, but the different kinds of the pine and fir tribes seem to be its favourite food, because it sometimes commits great ravages only on them, without touching the neighbouring trees. It is most frequently met with on the white and red firs, on the Scotch pine, and on the Austrian black pine, and it does not even despise the larch.

The moth is of the medium size; it sits during the day with its wings lying close to its body in a slanting direction, and when its wings are expanded, they measure above two inches from one point to the other. There are four or five black notched lines on the upper wings on a white ground, and there is a black spot between the middle ones. The light-grey lower wings have some cross wavy stripes, of a dark but faded colour. The lower border of all the four wings has a row of black spots, like dots, on both sides. The antennæ and palpi are black, and the head white. The front of the body is white with black spots, and the abdomen varied with black rings and red incisions, which, however, are sometimes wanting. The male is smaller than the female, and has strongly pectinated antennæ; while those of the female almost appear filiform, and are only furnished with short filaments. The abdomen of the female is pointed, and has an ovipositor.

The caterpillar when fully grown, measures from one and a half, to one and three quarter inches, the transverse diameter one line and a half. It is usually of a brown-grey mixed with black, and occasionally entirely black, sometimes, but still more rarely, it is of a whitish colour. The large head, covered with short hairs, roundly arched above and broad below, is grey, and it has a brownish line along the forehead, which ends in a triangular spot of the same colour over the mouth. Each of the twelve rings of the body has six warts covered with bristly hairs of a blue and brownish-grey colour, which are longest behind the head, and which give the caterpillar the appearance of having a pair of ears. Those that are on the back in pairs are of an indigo-blue colour. From the largest bluish-black spot of the second segment, is a dark brownish-grey stripe on the back to the seventh, and again from the antepenultimate to the terminal segment. This stripe on the back, which has a red knob on the tenth and eleventh rings, is bounded on both sides by a light zigzag line. The six true feet are yellow, or yellowish-brown, the others (or abdominal prolegs) are green, or brownish-yellow. They appear black from the egg, with a brown, glossy, shining head, and have two lateral tubercles. They are black after the first changing of the skin, and have a white stripe down the back; after the second changing, they have two white spots on the back, with long grey or black hairs; after the third, the head is round and shining black, and the whole appearance is of a motley greyish colour, and after the fourth, the caterpillar becomes more yellow and brownish. Wherever it goes, it spins a thread after it, out of the spinnerets under its mouth. If its resting-place be shaken, it hastily lets itself down and curls itself up.

It usually goes into the pupa state from the beginning of June to July, when the caterpillar is fully grown; the pupa is surrounded by a slight web, which is sometimes formed among the foliage, and sometimes over hollows of the bark, after which the caterpillar skin is cast off in three or four days. The pupa is three quarters of an inch long, at first green, then a brownish-red, and afterwards becomes somewhat darker, or rather blackish, with a metallic appearance. Each ring has reddish-brown tufts along the back, which are sometimes yellow. The anal extremity is furnished with hook-shaped bristles. The male is half the size of the female, which is stronger and has a larger body. When touched it moves with great activity. It remains in the pupa state seventeen or eighteen days, according to the weather.

The moth sometimes appears in the last days of July, or the beginning of August, but the late ones do not appear till September. After pairing, the female lays her eggs by means of her ovipositor in the cracks of the bark of the old pines, in the form of a bunch of grapes, to the amount of twenty or thirty in each cluster. As the ovipositor cannot be used on the beech, oak, and birch, she lays her eggs on the bark, and flaps her wings over them to cover them with the dust from her wings and body. One female usually lays one hundred and twenty eggs in the course of twenty-four hours, at three or four intervals. They are not spherical, but flat on two sides, and very sharp and rough to the touch. According to the latest observations of the royal Prussian head forester, M. Bülow Rieth, the eggs remain unhatched all the winter, and the young caterpillars only appear the following spring, in March and April. Immediately after they are hatched, they sit together as if in a nest near the place where the eggs remained all winter, quite motionless, and in a broad patch, from two to six days, enjoying the warmth and sunshine, and acquiring strength to ascend the trees. This period ought not to be neglected if it is wished to destroy a great many caterpillars with very little trouble. The greater number sit on the lower part of the stem; because the bark of the pine is rougher there than further upwards. They may be killed with a handful of tow made up into a roll, and beaten against them. Those that are higher in the tree, can be killed the easiest with a fly-trap, or bean-stalk, with which the caterpillars lying in the hollows of the bark may be crushed. The efforts of man against this insect are of very little use at any other time than when it is in the caterpillar state. Fortunately this insect only very seldom appears in fearful numbers in forests of pines or firs; and even then the injury it commits is not so great as that occasioned by the pine lappet caterpillars; because the black arch caterpillar only eats during the three months in which it attains its full size; and the pine lappet caterpillar eats during seven months. The former feeds also on a multitude of different kinds of trees, and is therefore the less destructive to the pine and fir; it also prefers the lower twigs, and often, if not always, spares the leading shoot of the tree. It appears to eat the young juicy foliage of the pine and fir only when necessitated to do so; but it is in the habit of completely stripping off the foliage of the stunted young pines, which grow under the old trees. Although these peculiarities render the devastation occasioned by these insects less considerable than that of some other insects, yet it is quite of sufficient importance to require the particular attention of all careful foresters. As a proof of this we may mention that Bechstein, speaking of the great destruction which this caterpillar occasioned in the years 1795 and 1798, in Vogtlande, in Prussia, and in some parts of France, observes that "the injury will not be replaced in a hundred years." M. Bülow Rieth, in his excellent treatise on this insect, also mentions, that in 1829, a district in the neighbourhood of Stettin, consisting of from three to four hundred acres, and covered with old pines, oaks, birches, and beeches was completely stripped of its verdure.

The best means for destroying these caterpillars should, according to the economy of the insect, be adopted by man. If he has obtained a sufficient knowledge of the eggs and their locality, he may collect many thousands of them with little trouble from August, to March or April of the following year. The young caterpillars may also be pursued successfully immediately after their escape from the egg, early in spring, as has been already mentioned. When the caterpillars are larger and stronger, and have distributed themselves over the branches of the tree, little more good can be effected, as picking, or beating them off is attended with great waste of time. It is much more advantageous to collect the pupæ in the end of the month of June and the beginning of July; only as soon as they begin to appear no time must be lost, as they remain in the pupa state but a very short time.

Searching for the moth, particularly by fire-light during the night, is almost useless, as it is only the males that fly to the light; this method is moreover very dangerous to the forester. It is more advisable to search for the females during the day, as they generally sit quietly on the trunks of the trees, and they should then be destroyed together with their eggs.

Should the number of insects be so enormous in any district that the destruction of the eggs and the young caterpillars, or the picking off the full grown caterpillars and pupæ should be found too laborious or impossible, Bechstein recommends that the whole of the trees in such a district should be cut down, or so pruned that the insects on them may be completely rooted out.

The black arch moth, like all other insects, has its natural enemies: to which belong the different kinds of insectivorous birds that live in forests. Besides these, however, which, according to Bülow Rieth's observations, are not sufficient to set an effective limit to the numbers of this enemy of the forest, there are some species of diptera, *Tachina*, Meig., (*Musca*, Lin.,) and several ichneumon flies, which are particularly serviceable in laying their eggs in the living caterpillar, and by this means preparing their destruction. There are four species of the former and five of the latter, which have been observed to live upon this *Bombyx monacha*. Bülow Reith does not give the systematic names of these insects, but only so short a description of them, that they cannot be identified with certainty. According to the assertion of this esteemed forester, the visitation of the insects injurious to the forests can only last three years; as in the course of that time their enemies are so increased that they completely subdue the moth. Unfortunately their enemies disappear at the same time as themselves; or at least, are so lessened in number, that on the sudden reappearance of the moth, favoured by unforeseen circumstances, they are not sufficiently numerous to produce their usual beneficial effects. For this end, Bülow Reith advises the annual rearing of flies and ichneumons, which may be effected by feeding a number of their grubs in a room, and putting them into the open air when fully grown; by which means he thinks that these beneficial insects will always find sufficient food and an opportunity for their increase. Whether this proposal, which appears to be useful, may not be too tedious, we leave to the judgment of the experienced forester.

THE PINE NOCTUA. *Noctua* (*Trachea*) *piniperda*, Autor. (*Achatia piniperda*, Hubn. Steph.)

The moth is from six to seven lines long, and when its wings are expanded it is one inch and a third or a quarter wide; the female is always larger, and has a thicker abdomen. The head is small, brownish-red, and very much covered with hair, its eyes lie deep, and its antennæ are bristle-shaped and of a whitish-brown colour; the thorax is brownish-red with whitish neck, and stripes of the same colour; the abdomen is of a gray-brown; the wings lying close to the body and bending downwards, the upper ones are finely notched on the margin and of brownish-red, changing to a yellowish tint from the base to the external margin, which has the appearance of marble, with two cap-shaped yellowish marks as characteristic signs; the cross stripes are edged with dark-red, the front ones straight, and the hinder ones waving outwardly; between these are the usual awl-like marks, the front one of which is round, and the hinder one kidney-shaped; the under wings are dark-brown with a reddish cast, and there is a red line close to the hinder edge, running through the white fringes; the under side of the wings is of an ochre or yellowish colour, shaded with brownish-red; a darkish shade runs from the base, and a dark-brown spot is generally in the middle of the upper wings; the feet are reddish-brown and yellowish spotted. This moth often varies in the colour of its upper wings and back.

The caterpillar is smooth, of a pale yellow, or whitish green colour before it first changes its skin; after the second moulting it has more colour, and after the third it has visible stripes on the back, which, with the fourth moulting, become perfectly distinct. It is then fully grown, viz. one inch and from six to nine lines long, and one and three quarters or two lines thick; the head is smooth, shining, horny, almost heart-shaped, and reddish-yellow; the body is cylindrical, somewhat smaller towards both ends, and grass-green with a white stripe on the back, and two stripes of the same colour, and one orange, or reddish-yellow, on each side; the latter being nearly close over the feet, immediately under the lowest white stripe. On a space of nearly the same breadth as the green spaces with white stripes, are four green, five white, and two red or orange lines. The under side of the body is green, and the feet are brownish yellow.

The pupa is about three quarters of an inch long, and three lines thick, enclosed in a web of the usual form, red, dark-brown or black, with two points a tthe tail; it is very agile. The male is smaller and harder than the female, and has a small elevation on its back.

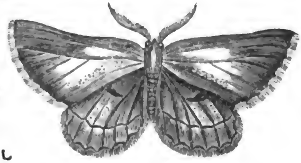
The caterpillar is found particularly on trees of from sixty to one hundred years old in pine forests, of which it eats the old foliage in preference; young trees and their young shoots are attacked by them only when the former are wanting.

The moth appears in April or May if the weather is warm, and sits by day on the trunk of the tree, frequently pretty high up; and it roams about during the night in the pine forests; the female lays from forty to sixty eggs of a pale-green colour, singly on the points of the foliage, and when she is very productive she lays from two to four together. After the lapse of fourteen days the caterpillars, which are very delicate, make their appearance, and eat during six or seven weeks to the end of July or the beginning of August; when they go into the pupa state in loose earth under the moss and leaves. They remain in this state all the winter, and appear as moths in spring. The caterpillar lives singly, eats more by night than by day, and does not crawl along the trunk like other caterpillars, but lets itself down by a thread, and does not willingly ascend again. This insect is very tender and sensible of the changes of the weather, particularly of wet and cold, which effectively check its usual increase.

Its enemies are the same insects and birds that are enumerated in the account of the preceding moth, and they are particularly destructive to this kind of caterpillar. When it is particularly abundant, it devastates the pine forests by consuming the foliage; and although this caterpillar has not become so formidable as the black-arch and pine-lappet caterpillars, yet it has occasioned considerable injury both in ancient and modern times. The means for guarding against, and destroying it are the same as those for the pine-lappet moth.

The Bordered White Geometra. *Geometra (Fidonia) piniaria*, Autor. (*Bupalus piniarius*, Leach, Stephens.)

When this moth (which is known in Germany under a variety of names) is at rest, it elevates its wings like the butterflies. The male is from six to nine lines long, and when its wings are expanded it is from one and a third to one and three quarters of an inch broad; the antennæ are brownish black, strongly pectinated. The body is slender, whitish-gray, with black dust, and yellowish at the extremity; the wings are upright, with white or pale yellow and dark brown spots. The upper ones are dull black, or blackish-brown, and there is a spot resembling a triangle which reaches from the base half way down the wings, of a white or brimstone yellow begrimed with soot. The under side is brown or ash-gray, often with minute yellow dots; there are two large white, or whitish-yellow spots towards the base, and one of a similar colour, but smaller, and covered with brown dots towards the tip of the wing, where there is a darker cross stripe. The under wings are white or sulphur-yellow, covered with dark brown dots; on the outer and posterior edge there are cross bands of two colours, the outer one of which is tolerably broad, and bordered with a fringe; the under-side is white, with yellowish brown or brownish-gray strongly marked spots, and having two cross stripes running through them of a brownish-gray



GEOMETRIA PINARIA.

or yellowish brown. The female is larger than the male. The antennæ are filiform and brown; the body is of a rusty colour above, and of a mixture of white and brown beneath. The ground colour of the wings is a rusty yellow, with two light-brown cross stripes, and with white or yellowish-brown spotted fringes. The upper wings are of a dull black or dark brown towards the edges; the under side is rusty yellow, becoming brownish gray towards the posterior edge, and with a spot on the point of the wing of a white and brownish-gray colour, and two broken brownish-gray stripes. The under-wings have an imperfect representation of the markings of the male; the under side is white, spotted and mixed with yellowish-brown, and with two yellowish-brown cross stripes. The male flies most in the evening twilight, and but little in the day, and with a quick, fluttering flight; while the female sits quietly on the branches.

The caterpillar, when young, resembles a small pale and yellowish-green worm, which can only with particular attention be distinguished from the foliage. It then becomes larger and whitish, and sea-green. After the first changing of the skin a white stripe is perceived on the back, and a yellow one on each side, all of which become more distinct when the caterpillar is half-grown, and have then two white lines added to them. When the caterpillar is full grown, it is from one and a quarter to one and a half inches long, and about two lines thick. The head and the three pairs of true feet are of a brownish or green colour, and the prolegs are quite green. The ground colour is green, with five stripes, running longitudinally, the middle one of which along the back is white, the others on each side are of a whitish yellow, and the one close to the feet is perfectly yellow. The pupa is half an inch long, of a shining light brown, with greenish wing-cases, and enclosed in a thin web.

The caterpillar prefers taking up its abode in pine and black-fir forests; where it is with difficulty distinguished from the foliage, because it is green, and sits closely on the leaves. It prefers eating the leaves of the pines to the sheaths when the trees are young, or of a middle growth. When they are very young, the caterpillars only eat off the outer skin of the leaves of the pines in patches, towards the point. They eat the foliage of the fir only when necessity compels them.

The moth appears in April, but is more numerous in May and June; it appears also sometimes in July and the beginning of August, and pairs both during the day and night on the stems of the trees. The female then lays her eggs on the foliage and twigs of the pine, from which the caterpillar is hatched in the course of four or six weeks, and eats until late in autumn, when it assumes the pupa state in moss, and the loose mould, in which it passes the winter. Wet weather is injurious to the propagation of this insect; cold less so, because a temperature of 28° Fahr. does not kill them, nor even prevent them from going into the pupa state. These caterpillars do not travel about, and at most only crawl from one tree to another; therefore when they have eaten a district completely bare, they either die of hunger, or go into the pupa state if strength enough remains.

This insect committed great ravages and became formidable in Bavaria, Saxony, and Pomerania, towards the end of the last century; and though the trees that were stripped of their foliage became green again the following spring, yet many of them died off by degrees.

The means for guarding against, and destroying, this insect, are the same as those recommended for the pine-lappet moth. Birds and insects are particularly fond of these caterpillars, and are very effectual in keeping them under.*

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* "At the end of 1832 a malady occurred amongst the fir-trees in the forest of Hagenau, one of very considerable extent near Strasburg, extending over 7000 hectares. The firs covering a space of about forty hectares were observed to have the leaves of a yellow colour and of a dead appearance. The cause of this malady was at first sought for in vain, but during the following year it was so much increased that more minute researches were made; and it was at length discovered that it was owing to the attacks of the larva of the Bupalus which commenced its ravages at the commencement of the month of

THE FIR TORTRIX. *Tortrix* (*Coccyx*) *Hircyniana*, Bechst.

The fir is sometimes stripped of its foliage by the caterpillar of a very small moth of the genus *Tortrix*, Linn. The perfect insect or moth measures from one tip of the wing to the other only five or six lines. Its palpi are white; but the head, back, and antennæ are brown, mixed with white; the abdomen is gray with whitish rings, and the feet are brownish-gray. The upper wings have a reddish-brown ground, on which are several spots of a dull silvery white, consisting of single small spots placed close together; the front edge has small dashes of the same kind. The spots sometimes run into imperfect bands; but in other cases seven large single spots have been ascertained, viz., three towards the outer, and four towards the inner edge. The fringes are pale gray, and two fine white dashes are seen on the points of the wings.

The under wings and the fringes are brownish-gray. The whole surface underneath is of a yellowish-brown gray, the outer edge of the fore-wings have the same dashes as the upper side; and there are two dashes in the fringes, but all are of a dull yellowish white.

The caterpillar is five lines long; it lives on the fir, and is full grown in autumn. It has a brown head, is without hair, of a yellowish brown colour and has two small, pale, reddish lines along the back, which sometimes varies to reddish; there is also a line on the back between the stripes, somewhat broader and darker. The first segment has a small, dark blue, shining, horny kind of scale, and each abdominal segment has eight reddish spots hardly visible, with single hairs proceeding from each of them. The first six feet are brown, the last ten are of the colour of the body.

May, passing from tree to tree until the month of October, when it descends to the ground to undergo its chrysalis state. The hundred hectares attacked in 1833, are now entirely destroyed without hope of future vegetation."—*Silbermann*, *Revue Entomologique*.

When winter comes on, the caterpillar lets itself down from the branches by a thread, and creeps into the earth to go into the pupa state.

The moth appears in many places in the beginning of May, and in the north of Germany at the end of that month.

It was only towards the close of the last century, says Bechstein, (to whom we are indebted for the history of this insect) that this caterpillar was observed to cause any great injury to our forests. In the Hartz forest it consumed the foliage of a large extent of fir-trees. The caterpillar rolls the leaves together in an irregular manner, pierces a hole in them, and feeds on the juice; the foliage then becomes loose on the twigs, and falls down, or remains hanging in the webs which are matted together with the excrement. When the caterpillars have exhausted their supply of food in one place, they travel farther in search of more. Generally only one caterpillar lives in a web. During the period of feeding, the trees are yellowish; and the following year they are deprived of all their foliage, and stand bare and dry. Generally a single tree is attacked, sometimes, however, from six to twelve standing near each other are stripped, and thus, in time, empty spaces are formed in the plantations.

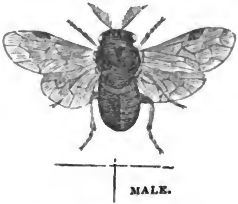
The enemies of this insect are the larvæ of parasitic flies, and among the birds, the titmice and golden wren.

THE PINE SAW-FLY. *Tenthredo pini*, Linn. *Pteronus pini*, Klug. (*Lophyrus pini*, Latreille, &c.)

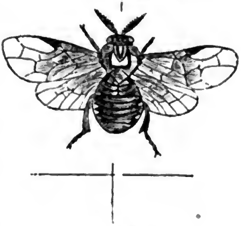
THE male and female of this insect, so highly injurious to the pine and fir tribe, differ so much from each other in size, form of the antennæ, and colour of the body, that they might easily be supposed to belong to two different species, if the observation of their economy did not afford proof to the contrary.

The male is always smaller than the female, and is from four to five lines long, including its antennæ, which are three quarters of a line long; it is one line broad, and when its wings are expanded it is seven lines wide.

The colour of its head is a dull black, and furnished with fine hairs often not perceptible. The antennæ resemble two bunches of black feathers; they are doubly pectinated, the teeth are shorter by degrees towards the point, and all of them are turned down and bending inwards, so that the antennæ appear hollow. The thorax is the colour of the head, and the abdomen is of a shining black. The legs, with the exception of the thighs (which are black), are of a dirty yellow. The wings are transparent and shining; the upper ones purple and green, varying into yellow, the anterior edge has an oval brown spot (stigma).



MALE.



FEMALE.

LOPHYRUS PINI.

The female is six lines long, including the antennæ, which are nearly one line long; the breadth of her body is somewhat more than one line, and when the wings are expanded nine lines wide. The head is brownish-black, clothed with fine yellowish-green hairs, scarcely observable. The antennæ consist of nineteen joints, roundish, and jointed into each other, obtuse inwardly, and resembling the teeth of a saw; the three basal joints are yellow, the others are blackish, and towards the point they become thinner. The thorax has four greyish-yellow compartments, divided by impressed lines, and in each of them there is a large black spot. The abdomen, consisting of nine segments, is black from the second to the sixth or seventh segment of the upper side, but the under parts are all of a yellow-grey. All the other parts nearly resemble the male.

The perfect insect, or fly, appears during warm weather in April, and continues till July. The general brood appears from the middle of May to July. After pairing, the female looks out for herself a place where she can with most safety deposit her eggs, in number from eighty to one hundred and twenty, and where she thinks she can find the most suitable nourishment for the future caterpillars. This food is, according to circumstances, either the foliage of the end of the last year's shoot, or that of the shoot not quite expanded. She remains sitting one or two days, until her eggs are sufficiently matured, and then begins to deposit them in the following manner. She first makes an incision the whole length of the leaf with her ovipositor, and hollows out the leaf from the edge towards the middle, so that one or two eggs can lie in the narrow space; the eggs are then laid in it, and closely covered up with a tough resinous material mixed with the substance scraped from the leaf. She proceeds in this manner till all the eggs are deposited on the several leaves. These leaves are easily distinguished by their rugged and unusually thick appearance in the places where the eggs lie.

After a space of sixteen or twenty-four days the caterpillars appear from the eggs, and are then about a line long. The head is brownish-yellow, or of a dark ochre colour, sometimes with a darker front, of the size of the head of a small pin, which stands somewhat out from the rest of the body. The mouth and the eyes are black. The body, declining from the head to the tail, is almost conical. The colour of the back is green, and without perceptible stripes, that of the under part and fore legs is a pale whitish-green. The abdominal feet are black, interrupted by light-green fleshy rings. When full grown the caterpillar is one inch, or one inch and a quarter long, one line thick, and on each of the twelve segments (the fourth excepted), there is a pair of feet; thus there are in all twenty-two feet, viz. six conical three jointed thoracic feet, which are black, and sixteen shorter abdominal prolegs, yellow or pale green, cylindrical, obtuse, and broad. There is a fine black line on the base of the feet, and over this on each segment a black spot, formed by dots placed close together, consequently there are twelve spots in a straight line. There are two oval fleshy elevations on each segment, between the two rows of black spots, the under one of which is horizontal, and the upper one vertical, and which are often united by a whitish string-like line. Both are furnished with fine bristles. The head is of a light rusty-brown, or dark ochre colour, the front dark brown, the eyes and the mouth black. The body diminishes gradually from the head to the anal extremity; the colour varies according to the age of the insect, the time of changing the skin, and the influence of the weather. The green of the young caterpillar becomes whitish-yellow, or dirty pale green, and before the last changing of the skin it is pale yellow.

This insect is very gluttonous. A full grown caterpillar requires from six to twelve strong healthy leaves daily, which it consumes from the point to the sheath. The young caterpillars leave the mid-rib standing; therefore in many places whole branches of dry, brown, curly-looking strings are seen on the trees; and they seldom attack a tree singly, but always in immense broods, without regard to its age. They are most numerous on the south side of the trees, where they have generally more light and warmth, and are protected against the wind. They prefer the foliage of the pine, and in default of it they attack the fir. Their growth is completed in about eight weeks. The time of their appearance extends from May to October, being found in the greatest numbers from the middle of August till towards the end of September.

They usually enter into the pupa state under moss and dry leaves, just at the foot of the tree, but sometimes in rents of the bark, and even in the foliage. The pupa case is from three to six lines long, obtusely rounded, brown, or drab-coloured, in preparing which the caterpillar is occupied from a day to a day and a half. There are not unfrequently several hundreds of pupæ close together, so as often to form a heap of the size of a man's fist. They remain in the pupa state eight or nine months.

The great number of these caterpillars, (according to the latest experiments which the Royal Bavarian forester, Dr. Ernst Müller, has made, and detailed in his work on the attacks of this insect) causes, perhaps, as serious an injury to the forests of pine and fir, as the attacks of the pine lappet moth, the black arches, and the devastations of different kinds of bark beetles, &c. According to Müller, these caterpillars were so numerous in 1819, in the month of November, in some of the pine forests in Franconia, that none of the foliage could be seen for them. They fell in thousands from the trees, collected themselves in heaps, not unfrequently of the size of a man's head, and marched in dense flocks from those trees that they had stripped to those that were still green. The trees that were completely stripped of their foliage, and particularly the young wood and underwood, had in the course of the winter and spring already shown signs of immediate death, and those which still exhibited the power of life were quickly hastening to dissolution, although in all the shoots were formed for the following year, and lay in embryo when the caterpillars began their attack. In the former the sap-wood and inner-bark was withered and swelled, having a scorched appearance, the wood was dry and crumbling, and the buds of the principal and side shoots were dead and quite dry. The latter had all these symptoms in an incipient state, and their speedy destruction was inevitable.

If the equilibrium of the organic kingdom of nature (only disturbed at certain periods) were not sufficient to keep this insect in check, and each generation were propagated uninterruptedly, without a single link of it being destroyed, in the course of a certain number of years all the forests in the world would not be sufficient to nourish them. According to Müller's calculation, a single pair of this saw-fly (as the female lays one hundred eggs) would, in ten years, produce an offspring of nearly two hundred thousand billions, a number for the support of which all the German forests would not be sufficient.

The checks which nature has put on their increase are two. The one is a certain state of the weather, which is sure to cause their death, and the other is a favourable state of the weather, which increases their enemies. Unfavourable weather is not equally injurious to all the states of development of these saw-flies. They are the most sensitive when they are young caterpillars, or at the time when they change their skin. If continued cold and wet weather set in at this period, or hoar-frost occurs during the night, thousands of them are destroyed. A similar state of the weather at the time of pairing has also a favourable effect; because, although it does not prevent the saw-flies from propagating their species, it makes the caterpillars at least indolent and incapable of removing into distant quarters hitherto spared from their attacks.

The number of living creatures which contribute to lessen the number of the saw-flies is very great, particularly insectivorous birds, and even some of the mammalia. Amongst the insects which destroy them may be reckoned the different kinds of ichneumon flies, the principal of which are ten in number. Some of these attack the eggs, others the larvæ, and others again the pupæ. Besides these, different kinds of flies (*Musca*, Linn.) are their dangerous enemies. Among the birds, the most useful destroyers are the green woodpecker, the great red, or various-coloured woodpecker, the black woodpecker, and the nuthatch. Among the mammalia, mice stand the first, particularly the field-mouse (*Mus sylvaticus* et *arvalis*, L.). These animals destroy the greater number of the pupæ that are lying on the ground; hundreds of which are often found empty near the holes and passages made by mice. Still more useful (separately considered) than the mice, are the squirrels; in the stomach of one of which the forest director, Müller, found more than a hundred of these insects in the pupa state.

The means devised by man for guarding against and destroying the pine saw-fly are as follows:—The numerous caterpillars on their journeys should be collected together and burnt. Branches of pine should be strewed so as to collect the remaining caterpillars, which are very fond of assembling in them; the branches should then be shaken, and the caterpillars hidden in them trodden upon and crushed. The branches on which the caterpillars sit in great numbers, should either be cut off and burnt, or they should be shaken whilst the caterpillars are in a half torpid state, when they will fall and may be easily destroyed. Trees and districts that are attacked should be separated by trenches from those that are not attacked, that the caterpillars on their journeys may fall into the trenches, where they may be easily collected and destroyed. The trenches should be at least two feet deep and the same in breadth; and their sides should be as perpendicular as possible.

The dry foliage and moss must be conveyed from those places where the trees are attacked, and given to the husbandman to use as manure, with directions to pour over them some liquid manure before it is added to the dung heap. In this manner the pupæ of these insects will be with the most certainty removed from the forest; particularly if the moss be taken away from the stems of the trees, where the pupæ are often lying in patches; as they are also in the cracks of the bark, and on the bark itself. Those pupæ that are scattered about on the ground should be picked up, and the best way is to employ children and women for the purpose. It is very advantageous to clean the bark with pointed instruments, so as to get the pupæ out of the rents of the bark. It is also advisable to cover the stems with sand a foot and a half high, and as broad on the ground; as the larvæ and pupæ thus will not easily escape from the chinks, particularly in old trunks, where the bark is very hard, but must be stifled in the sand, and those saw-flies that are developed cannot make their way out of the sand into the open air.

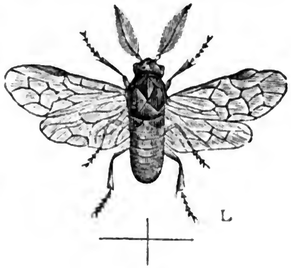
Turning pigs into the attacked districts is not so useful with this insect as with others; as the pigs will neither eat the caterpillars nor the pupæ, which have a leathery kind of case. In young woods of twenty or thirty years' growth, the trunks of the trees should be shaken early in the morning, when the air is cold, and the caterpillars are lying stiff on the foliage; the fallen ones should then be destroyed by treading, and green twigs of the pine should be laid down, so that those that remain may assemble in them, and may easily be destroyed. When the saw-flies appear, children should collect the perfect insects, and pick off the leaves in which the eggs are already laid; but it will be understood that this ought only to be done under the directions of individuals who know this insect and its economy sufficiently.

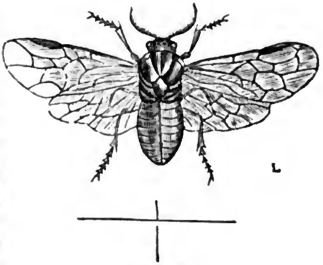
There are many other methods recommended besides these, such as killing them by firing at them, watering them with soap-suds, or a corrosive lye of tobacco leaves, smoking them with brimstone, stifling them with thick wood or peat smoke, powdering them with corrosive substances, and the like; but the practical forester, who has observed the devastating consequences of the attacks of this caterpillar, must be convinced that all these known methods are useless or impracticable, and many of them even ridiculous.

THE FOX-COLOURED SAW-FLY. *Tenthredo* (*Pteronus*) *rufus*, Klug. (*Lophyrus rufus*, Latreille.)

A species of saw-fly, very nearly allied to the preceding, appeared in considerable numbers in the spring of 1833, in the pine and fir forests near Wolkersdorf, not far from Vienna, and occasioned the greatest uneasiness. At the request of Baron Binder von Kriegelstein, I went to see the district attacked by this caterpillar, in the middle of June, partly to ascertain what insect it was, (as it had never been seen in our neighbourhood, or at least never appeared in such numbers as to attract the attention of the forester, and consequently was unknown to us) and partly to ascertain the degree of injury it had committed; also to propose the most effectual remedy for its present destruction, and the means of prevention for the future.

The greater number of the caterpillars had disappeared on my arrival, and I only saw one here and there on the trees; most of them were destroyed by the exertions of the royal forest-ranger, Baron von Hagen, who had them collected and thrown into large tubs of water. The others were already in the pupa state in the earth. The damage sustained from their ravages was fortunately not very considerable, partly because the late frosts which came on in the month of May destroyed a great part of them, the skins of which I saw hanging on the branches, and partly from the effectual measures of the forest ranger, which gave them a powerful check. The attacked district consisted principally of silver firs, mixed with a few black Austrian pines, and extended about eight acres; the caterpillars were for the most part found on young trees of not more than ten years' growth, while the old ones remained untouched. Those woods that were attacked certainly looked thinner than those that were untouched; but the trees recovered by the following autumn, so that no trace of the injury was perceptible.


MALE.


FEMALE.

LOPHYRUS RUFUS.

The saw-flies appeared from the pupa in the end of August or the beginning of September; and, as already observed, they very much resemble the *Lophyrus pini*, being a little smaller. The male, when alive, is three lines long; the upper side of the body is shining black, the lower part of the abdomen brown, the legs reddish-brown, the wings light and transparent, with a black marginal mark (*stigma*). The antennæ are similar to those of the foregoing species. The female, when alive, is three and a half lines long; the body is of a yellowish-brown, only the thorax at the insertion of the wings is spotted with black; the wings are transparent, varying in colours like the rainbow, with the veins and the marginal mark yellowish-brown; the antennæ are black, except the two basal articulations, which are of the same colour as the veins of the wings; the legs are entirely yellowish-brown. The female also bears a great resemblance to the preceding species.

The caterpillar, when fully grown (I had not an opportunity of seeing it when young), measures nearly six lines, and its transverse diameter one line. The body gradually diminishes from the head to the tail. The ground colour is greyish-green, sometimes lighter, and sometimes darker, according as the insect has just changed its skin, or is near doing so. A lighter stripe runs all along the back, and a similar one runs on both sides from the head to the tail, on which there is a black longitudinal line, which is followed by a lighter stripe; and finally there is a blackish line at the insertion of the feet. The head is horny, shining black, with two very small distinct black eyes; the organs of the mouth are also black. The number of the feet is the same as that of the feet of the *Lophyrus pini*, the first three pairs are black, with pale rings at the joints; the ventral feet are wart-shaped, and of a paler colour than the ground. When moderately magnified, the skin appears wrinkled across, and covered with very short, stiff black hairs.

These caterpillars live together very socially, and sit two and two on a leaf, one opposite the other, with their heads upwards, so that the slightest agitation causes them to move to and fro. When the time arrives for them to go into the pupa state (in June), they leave the tree on which they fed, and make a cavity close to it a line deep in the earth, where they form a parchment-like, brown, oval cocoon. The perfect insect appears towards the end of August or beginning of September, and the female lays her eggs in the foliage, immediately after pairing, in the same manner as we have described that of the *Lophyrus pini.*

The methods of destruction are the same as those recommended for the foregoing species; ichneumon flies also contribute most essentially in lessening the numbers of these insects.

The Red-Headed Saw-Fly. *Tenthredo* (*Pamphilius* Latr.) *erythrocephala*, Fabr. (*Lyda erythrocephala*, Jurine.)

Young pines and firs sometimes suffer from the attacks of a tolerably large caterpillar, essentially different in its manner of life from the very destructive fir saw-fly I have already mentioned. This caterpillar does not sit openly on the foliage, but resides in a peculiar cocoon made by itself on the trunk, or on the branches among the foliage of the young pines and firs. I obtained this information, in the beginning of July 1831, in the Vienna Botanic garden, where these caterpillars partly consumed the leaves of several young pines (*Pinus Cembra*, Linn.); I afterwards found the same insects in several gardens and parks, and also in open places on trees of different kinds standing singly, and even on exotic pines and firs. The caterpillars appeared to prefer eating in the evenings, and remained concealed in their cocoons during the day, so that they were with difficulty to be discovered. If it is observed that the young trees lose their leaves without any insects being perceived upon them, the stems and the branches should be carefully searched; and the author of the devastation will be discovered in a somewhat loosely-woven cocoon, composed of a kind of skin intermixed with the excrement of the caterpillar. The caterpillar itself is of a pale or dingy green, from nine to ten lines long, about the thickness of a quill, with many transverse wrinkles or folds; a dirty reddish stripe runs along the back and sides; it has three pairs of thoracic feet, and two short thread-shaped three-jointed filaments on the last ventral segment. The head is pale-yellow, shining, with three black dots in a triangular spot on the forehead, and black eyes; the antennæ are very short, brownish and more slender at the extremities. When fully grown the caterpillar leaves the tree, and enters the earth to undergo its pupa state. The perfect insect appears early in spring on warm days, and in the evening roves about the pines and firs, on which it lays its eggs.

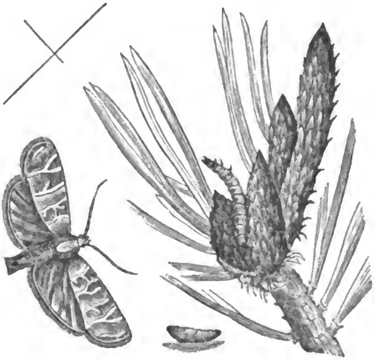
This saw-fly is easily distinguishable by its colour; the whole of the male is steel-blue, except the organs of the mouth, which are yellowish. The female has also a steel-blue body, but she has a reddish-yellow head. There are some yellow transverse stripes on both sexes on the under side of the abdomen, and the tibiæ of the first pair of feet are yellow; the wings are strongly veined, and transparent, the upper ones, from the base to beyond the middle, steel-blue, the other parts and the under-wings are of a dark smoke colour. The length of the whole body is from five to six lines; the female is always somewhat larger, has stronger palpi, and a broader abdomen.

The only means of destruction consists in searching for and killing the caterpillar in the month of June. The ground near the trees may afterwards be loosened, in order to bring the pupæ more to the surface, and to expose them to the influence of the weather.

2.—*The caterpillars of some of the smaller moths of the genus Tortrix*, Linn. (*leaf-rollers*) *select the young shoots and buds of the Scotch pine*, (*Pinus sylvestris*) *and the black Austrian pine (Pinus nigricans) for their dwellings and nourishment.*

THE BUD-TORTRIX, *Tortrix* (*Coccyx*) *Turionana*, Autor. (*Orthotœnia Turionana*, Stephens, Curtis.)

WHEN the wings of this moth are extended it only measures seven or eight lines across; its head and back are of a of a pale rusty-red, the abdomen, antennæ and feet, are brown, the former with whitish joints. The upper wings are of a rusty-red, or reddish cinnamon-coloured ground, which is sometimes darker, and almost of a brownish-red, having pale-blue, or whitish-grey, silver-shining marks on it. There are also similar solitary spots at the base of the wings, then follows an imperfect band, and behind it, towards the fringed border, are several silver lines. A brownish-red row of spots is sometimes seen above the white fringes, and a fine line of the same colour as a boundary. The under-wings are whitish-grey in the male, darker towards the fringes, which are white in the male also; in the female the under-wings are dark grey throughout. The under side of the upper wings is dark ash-grey, the fore-edge yellowish-striped, the under-wings are pale grey. The moth sits, in July and August, on the bark of the tree, which it resembles so closely that the eye is easily deceived.


ORTHOTŒNIA TURIONELLA.

At this time the female lays her eggs on the points of the buds of young silver firs, from which the caterpillars appear in ten or twelve days, and live on the bud till the end of October, and even penetrating to the turpentine tubercles with which the silver fir abounds (see Loudon's *Arboretum Britannicum*, vol. iv. p. 2334). By the end of October the caterpillar is feasting on the interior of the largest middle-bud, beginning below that which is formed for the following year, in which it spends the winter, and forms its pupa in the following April. The pupa approaches the outlet towards the end of June, when the moth makes its appearance.

The full-grown caterpillar is brownish-red, with darker transverse rings and a shining brown head; and it is nearly half an inch long. If the trees are not entirely killed by this insect they are at least injured in their straight growth; particularly when the heart-bud of the leading shoot, which forms the continuation of the stem, is destroyed. It may easily be perceived that this insect and the following one are the principal causes of the crooked growth which is perceived in the branches of the pines. Nothing more can be done towards the destruction of this insect than destroying the turpentine tumours, particularly about the end of October, while the caterpillars are in them; or cutting off and burning every shoot infected with them. The latter method may be avoided, and the shoot saved, if the resinous tubercle is destroyed before the caterpillar penetrates through it into the alburnum of the tree.

Tortrix (Coccyx) Buoliana, Fabr. (*Tortrix Xylostiana*, Hüb.)

This moth is very variable in its size, but it is generally, however, larger than the preceding. Large specimens, when their wings are extended, measure from nine to ten lines. The head and the mouth organs are pale yellow, the thorax brownish, with red and whitish-yellow tippets, the abdomen is covered with silvery shining scales, the antennæ and feet are brown, powdered with white; the upper wings appear reddish-yellow towards the base, but towards the opposite end they are dark orange-red. Light stripes, issuing like rays from the base, run generally towards the fore and inner edge, and several tortuous silvery transverse lines and spots appear on the whole surface; the lines being generally connected together towards the posterior margin, but no two specimens are alike. A row of silver dots is seen near the posterior edge. There is a yellowish line and a bluish one which form a boundary to the fringes. The fringes are of a dull white. The under wings are blackish-grey, with a yellowish reflection, the fringes are yellowish-grey surrounded by a yellow line and a grey one.

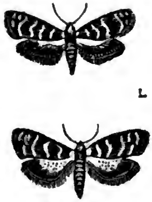
The whole of the under side is blackish-grey, all the outer edges are whitish, and the anterior margin of the upper wings varies into reddish. The moth appears in July, sits during the day on the withered shoots of the young pines, and as it so much resembles these shoots and the scales in colour, it is difficult to perceive it. The female likewise lays her eggs on the young shoots, and the caterpillars live till the following May under a resinous tubercle, after which period they go into the alburnum of the shoot, and become pupæ there. The full-grown caterpillar is nearly an inch long, tolerably thick, skin wrinkled, dingy yellowish-brown, the small flat head shining black, the scaly plate on the first segment blackish-brown, with very fine white middle stripes, and the anal extremity blackish. The pupa is yellowish-brown, head and wing-cases darker.

These caterpillars are particularly abundant near Vienna, in the young black Austrian pine forests, and as they always select the strongest trees, and generally the middle or leading shoot to feed on, they occasion considerable injury, as they force the tree to form its principal stem from one of the side shoots, by which a greater or smaller check is given to the whole plant, which is thus not only retarded in its growth, but rendered crooked, and consequently unfit for timber.

The methods used for the destruction of this insect are the same as those for the foregoing species, its habits being the same.

THE TURPENTINE MOTH, *Tortrix* (*Coccyx*) *resinana*, Autor. (*Orthotœnia resinella*, Steph. Curt.)

The caterpillar of this moth is also an enemy of the fir-forests. The moth, when its wings are extended, measures eight or eight and a half lines; it is blackish-brown on the upper side, the head, back, antennæ and upper wings, are the darkest; the abdomen, feet and under wings, approach more to grey; the palpi are brown, somewhat mixed with white. About five silvery lines formed of single spots run along the back; the outer ones being the broadest. All of these generally proceed from double spots on the anterior margin. A silvery line as fine as a hair forms the boundary above the fringes. The under wings are of a darker brown, and have a yellow and brownish line above the fringes, which are dull white. The whole surface below is light greyish-brown, the commencement of the silver lines of the upper side is seen on the front edge of the upper wings.



TORTRIX RESINANA.

Oval masses of dry, white, powdery resin are often seen on the silver firs, particularly on the extreme shoots of the branches. These masses are formed by the caterpillar of this turpentine moth, which lives in them and undergoes its transformation there. It is ochre-yellow, with a brownish-red head and throat. When these insects are in danger they let themselves down to the ground by a thread, and ascend again by it when they think they are safe. They attain their full size (which is a third of an inch long) in the month of October. In this state they pass the winter in a thick white web, and their transformation does not take place till the following spring.

The pupæ are at first yellowish-white, afterwards brown, and finally black. The abdomen remains brownish. They cannot bear the open air, and wither up if they are taken out of their abodes.

The moth appears in May and June. The female lays her eggs on the new shoots of the pine and fir, which about this time are nearly a finger's-length long. The caterpillar appears in eight days, gnaws the young shoots till it reaches the alburnum, and obtains its nourishment from the sap, which issues from the opening, and which it contrives to keep always flowing, so that an excrescence is formed which gradually increases, and becomes hard externally. The upper part of the shoot withers in consequence, and the lower part which is not withered, only puts out side-shoots the following year. In this manner the growth of the trees is so very much injured, that they are rendered unfit for timber, and can only be used as fire-wood.

Rösel recommends cutting off the resinous excrescences from June to August for the use of the lamp-black burners; but as this is not of any considerable use, it is better to annihilate both caterpillars and pupæ by destroying the resinous knot when the insects are within it.

3.—*Pine and fir forests sometimes sustain great damage from the well-known and much dreaded bark-beetles, several weevils, a few long-horned beetles* (*Cerambyx*, Linn.), *and the large species of the genus Sirex*, Linn., *which injure the bark, the inner bark, and even the wood.*

The bark-beetles are by far the most formidable amongst the insects here enumerated, as, by their extensive ravages among the different kinds of pines and firs, they occasion the disease termed, in Germany, worm-withering. They take their name from the place of their abode under the bark, where they find their food, consisting partly of the alburnum, and partly of the inner layers of the bark itself; and they are generally distinguished by a slender cylindrical body, a strongly arched thorax, clubbed antennæ, and small strong legs. Many species have their wing-cases posteriorly obtuse, by which a hollow circle is formed, which is more or less furnished with short teeth on the margin.

According to Fabricius, the bark-beetles are divided into two genera: viz. *Bostrichus* and *Hylesinus*, the first of which is distinguished by the thorax being obliquely truncate in front, and forming a hood over the head; and in several species, by there being a concavity at the extremity of the wing-cases. In the genus *Hylesinus*, on the contrary, there is no hood, but the head is produced into a short broad rostrum, and the wing-cases are never obtuse.

The following insects are the most destructive species of both genera.

THE TYPOGRAPHER BARK-BEETLE. *Bostrichus typographus*, Fabr. (*Tomicus typographus*, Latreille.)

This insect is the most destructive of all the bark-beetles. It particularly attacks the silver-firs (*Picea pectinata*), but when that tree is not abundant, or when the number of caterpillars is very great, they find their way to other species of pines and firs. The perfect insect or beetle is from two to two and a half lines long, and from one to one and a quarter broad, and hairy. Immediately after its development it is rusty-yellow as long as it remains under the bark, it then becomes darker by degrees, and after it escapes into the open air it is of a brownish-black. Its jaws are sharply toothed, and its eyes dark-brown; its wing-cases are deeply punctured, broader behind, deeply and obliquely impressed, the impression with crescent-shaped margins, which have from four to six irregular teeth. The thorax and sternum are always darker than the wing-cases. The female is distinguished by a thicker abdomen, less covered by the wing-cases. The larva, or maggot, is three lines long, wrinkled and white when it leaves the egg; its head becomes soon after yellowish, and the back reddish striped; the jaws are sharp; the antennæ short, and the feet six*, and yellowish.

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* The feet are wanting in the larvæ of *Tomicus* and the allied genera, resembling those of the weevils.

The nymphs, or pupæ, are at first white and soft, becoming harder and yellower by degrees; they are almost the form of the beetle, only with pale indications of wings, and the feet drawn up under the body.

As already mentioned, this insect lives in the fir forests, and generally attacks trees of from eighty to a hundred years' growth, the bark of which is not very hard. The insects are found under the bark of sickly, dead, or felled trees, where they feed on the stagnated sap of the inner bark, which has undergone fermentation; and it is only when, from the unusual increase of this insect, a sufficient supply of this food cannot be obtained, that it attacks the silver-firs with sound trunks, or any other species of the pine and fir that are near.

Two broods of this insect are generally observed in one year; the first in May or June, and the second in August or September, when their increase is considerable. The perfect insect appears also in the other summer months, according to the state of the weather. As soon as the beetles leave the place of their birth, they fly, sometimes high and sometimes low, according as the weather is warm or cold, in swarms more or less numerous, each selecting a female, when they propagate their species on the growing or felled trunks which are to serve for the future nourishment of their young. The male dies soon after pairing, after he has assisted in boring an entrance hole for the female to lay her eggs. This hole is made in the trunk of the tree, slanting upwards, from half an inch to one inch deep, as far as the sap-wood, and from it the female alone hollows out a perpendicular canal in the inner bark, from one to four inches long, on both sides of which she forms small hollows close together, and in each of these she lays a small, round, white egg, which she covers and pastes down with what the Germans call worm-meal. After a lapse of fourteen days the larvæ appear if the weather is fine, and gnaw tortuous passages, which become wider by degrees, and extend above and below, and which, on account of their resemblance to letters, have obtained for the beetle the name of typographer.

The larvæ gnaw the longitudinal vessels of the inner bark, and deposit the residue as excrement in the form of a reddish worm-meal. It is observed as a remarkable peculiarity, that the numerous beetles boring in their canals close together never cross each other, and that the oblique passages of each family, and even of each member of a family, can easily be distinguished. After the larvæ are fully grown, they gnaw out wide roundish hollows, in which they remain lying a few days without food; they then cast off their yellowish wrinkled skin, and appear as nymphs, which by degrees assume the appearance of the perfect insect; for as soon as the wing-cases are fully grown, they burst their covering and throw it off. The transformation from the egg to the perfect insect is accomplished in eight weeks in fine weather, therefore there are often several broods in one summer. The last brood in autumn is, however, generally retarded by wet and cold weather, and the beetle, or the not yet fully formed nymphs remain at rest, concealed under the bark till the following spring, when they escape in the form of perfect insects to continue their species.

Warm and dry summers, followed by a dry and cold winter, are favourable for the propagation and increase of all insects injurious to forests. Hot weather shortens the period of transformation, and thus by affording time for the maturation of several broods, causes a superabundant number of insects to be found. As all these circumstances were combined in the years 1811, 1819, 1822, and 1827, in a greater or less degree, considerable devastation was experienced from the attacks of this insect in the silver-fir forests in some parts of Austria. This was the case in the estate of Schönbüchel, not far from Vienna, the property of Count Beroldingen.* On the contrary, damp and cool summers, and winters alternating with wet, frost, and cold, are effectual in lessening both the numbers of the insects and their destructiveness.

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* Count Beroldingen has contributed very valuable papers and observations on this subject in the *Transactions of the Imperial and Royal Agricultural Society of Vienna*, 1833. Vol. I. pp. 86 & 97.

The injury this insect does is chiefly effected by the larvæ, which destroy the sap-wood, and thus, if they are numerous, kill the fir, although previously quite healthy, in the course of a few weeks. When this is the case the larvæ also attack and destroy indiscriminately pines, firs, and larches that are growing near. This beetle rendered itself formidable towards the end of the last century in the north of Germany by considerable devastations in the forests.

The means of protection from the injuries of this and similar insects consist, first, in methods for prevention, and secondly in methods for lessening the number of, or for destroying, the insects themselves. We can only experience the good effects of both, when they are put in practice in all forests in any quarter, whatever be their situation.

Methods of prevention.

1. Attention should be paid to encourage the increase of all the natural enemies of the beetle and its larvæ, to which belong the different kinds of insect worms, beetles, burrowing wasps, ants and birds, particularly the finch, the tomtit and woodpecker, which are more eager after the beetle than the grub; and which, in this respect, are the most effectual destroyers.

2. Attentive search should be made among the trees during the summer months, and when numerous borings of the beetle are perceived on declining trees, they should be felled, and the search repeated at short intervals among the others. The bark of every tree found to contain a new brood, should be carefully taken off, and burnt with the insects. As the beetle from its natural instinct retires to the trunks of felled trees, and places her brood there, this brood may be destroyed in the easiest manner by stripping off the bark. This method, put in practice at the right time, is sure to succeed in extirpating the insect, if continued until beetles are no longer found on the trunks of newly-felled trees. The stripping off the bark, however, from

these trees ought not to be neglected at the proper time, otherwise the evil would not fail to return.

3. Regular and well-arranged forest-management, including lopping to prevent accidents from wind; frequent examination of the trees; the quickest possible stripping or uprooting of those found to be infested; the speedy cutting up and conveying out of the forest of the wood intended for fuel, or that which is broken off by the wind; the felling and carrying off all useful timber before the month of May, if possible; and lastly, a prohibition against a too free use of the resin-knife, cutting out the resinous parts of the wood for making fires, carrying off the withered leaves, &c.

2.—*Methods of destruction.*

When the bark beetles have already become numerous.

1. Felling the first bored stems without delay, and burning them into charcoal, or conveying them out of the forest as soon as possible, or at least taking off the bark, which should be carefully burnt.

2. The application of all preventive measures, particularly extending that of No. 2, by the more frequent felling of a number of attacked trees.

THE PINASTER, OR RED, BARK-BEETLE. *Bostrichus* (*Tomicus*) *Pinastri*, Bechst.

This beetle is red or chestnut-brown; the wing-cases are striped longitudinally, and very much hollowed out behind; the thorax is lighter than the wing-cases, and there is a smooth, dark tubercle on the upper side of the latter. The insect is double the size of the common bark-beetle. The larva is three or four lines long, and as well as the nymph has nearly the appearance of those of the foregoing species.

According to Bechstein this bark-beetle is found exclusively in pine-forests under the bark of growing and felled timber, and gives the preference to old trees.

Its food, propagation, enemies, destruction, and methods for protection against it, are the same as with the common bark-beetles; only with this difference, that instead of fir-forests, the pine-forests are attacked, which have not as yet sustained much injury by this species. It is found in considerable numbers committing its devastations where caterpillars have previously made attacks, thus accelerating the sickliness or death of the leafless stems.

THE LARCH BARK-BEETLE. *Bostrichus* (*Tomicus*) *laricis*, Fabr.

The beetle is black, has club-shaped antennæ, punctate-striated, wing-cases notched at the tips, and brown feet; it is one line and three quarters long, being considerably smaller than the common bark-beetle, to which it bears much resemblance. Varieties of lighter or darker colours are not unfrequent. The larva is of a milk-white, has a brown head, and is covered with fine hairs. The pupa is of a rusty yellow. The food, abode, enemies, &c. of this beetle do not differ from those of the common bark-beetle, except that the one lives upon the larch and the other on the silver-fir.

BOSTRICHUS LARICIS.

THE SPRUCE FIR BARK-BEETLE. *Bostrichus* (*Tomicus*) *orthographus*, Duftschm.

In the end of April M. Von Kleyle sent me some pieces of the spruce fir (*Abies excelsa*) from the garden at Baden (near Vienna) belonging to his Imperial Highness the Archduke Charles, and stated that several of his trees were being destroyed by this beetle in the following manner. In the bark of the pieces of wood sent to me a few holes were seen about the size of a pin's head; and under these were numerous irregularly winding paths, near to each other, and filled with small bark-beetles and their larvæ. After a long examination I ascertained this beetle to be the *Bostrichus orthographus* described by Duftschmid.

The small beetle is not much more than a line long, of a shining black, with a yellow tuft of hair distinctly seen on its head. The thorax is pretty strongly arched in front; and in the middle, as well as at the sides, it is quite rough from deep punctures, and it is likewise covered with yellowish hairs, particularly on the anterior margin. The upper hinder part of the thorax is shining, and also punctured, but the punctures are shallow, and only visible under a magnifying-glass. The wing-cases are very distinctly punctured; the punctures are large and deep, and stand in longitudinal rows parallel with each other; the wing-cases are obtuse at the end, and moderately hollowed. The margins of this hollow are furnished with several teeth, or points, on both sides of which there are three longer than the others. The wing-cases are covered with yellow hairs, particularly at the ends. The antennæ are light yellowish-brown, the legs pitch-brown and the *tarsi* alone lighter.

The larva is also only a line long, yellowish-white, and much wrinkled; the head is yellow and shining; the jaws are strong and brown. I could not perceive any feet with the highest magnifying-glass.

The methods of destruction recommended by the most experienced foresters are the same as we have already described for the bark-beetles. No time must, however, be lost in removing the injured trees, because as the beetle appears in April, it undoubtedly pairs and lays its eggs early in spring.

THE SCOTCH PINE BARK-BEETLE. *Hylesinus (Hylurgus) piniperda*, Fabr.

This beetle is somewhat shaggy and black; the wing-cases are pitchy-black, irregularly striated, entire at the tips, thorax somewhat anteriorly narrowed, antennæ and feet brownish-red. The larva is thick, cylindrical, milk-white on the middle of the body, the head dull yellow, also the front of the body and the anal extremity, but somewhat lighter. The pupa resembles that of the common bark-beetle.

The abode and place of propagation of the perfect insect or beetle are in the pith of the young shoots of the pine, particularly in the side twigs. The beetle burrows for one or several inches below the terminal bud on the youngest shoots, eating out the pith straight upwards, and gnawing out again near the bud or through it. According to Bechstein, the beetle bores through shoots of the spruce fir when there are none of the Scotch pine to be had. The eggs are laid under the bark of sickly and felled pines, also on the silver and spruce firs, in the bark of which the maggot also lives. The food of the beetle is the pith of the young shoots of the pine; and the maggot lives on the stagnated fermented juice under the bark. The mode of its propagation and its enemies are the same as those of the common bark-beetles.

Modes to be employed for its destruction, or for preventing its ravages.

The larvæ feed on the trunks of dead or dying trees, and the beetle only places her brood on healthy trees when necessity compels her to do so. The methods for prevention and destruction which have been pointed out for the common bark-beetle may be applied to this beetle also; but it is more difficult to prevent its devastations on the young shoots, which frequently become serious. In young woods, cutting off the attacked shoots and burning them, is the only successful method, which, however, cannot be applied to lofty trees. In one respect the ravages of this insect do less injury to the forests than those of some others, inasmuch as it generally only attacks the side twigs, leaving the leading shoot untouched.

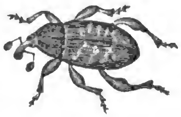
Müller, the royal Bavarian forester, had an opportunity, in 1819, of observing these beetles, and found them so numerous in several pine woods of sixty and eighty years' growth, that they occasioned the extreme points of the side shoots to become yellow; yet the main shoot was spared, and the stems grew the following year as formerly, without being perceptibly weaker.

Besides the bark-beetles here enumerated, there are many other species which, either alone, or in company with other insects, are injurious to the forests; as their mode of life is, however, nearly the same, and as from their having the same natural enemies, they must be subdued by the same means as above described, we have thought it unnecessary to extend the size of the work by detailed descriptions of each.

As, according to the observation of Dr. Ratzeburg, the weevils are particularly injurious to the young pines, we will treat of the most important of them here; and will refer the reader to the treatise containing an account of the others mentioned in the note.

The Pine-weevil. *Curculio* (*Hylobius*) *Abietis*, Schönh. (*Curculio pini*, Linn.[*])

This weevil is particularly injurious to the pines, and Dr. Ratzeburg has made us acquainted with its natural history in the treatise mentioned in the note below. The beetle is one of the larger weevils of our neighbourhood; it measures nearly six lines long, without reckoning its long rostrum, which inclines downwards, and measures one line and a half long. The thorax is smaller than the abdomen, which is almost cylindrical; the other parts of the body are dark brown. The rostrum points



CURCULIO PINI.

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[*] Dr. Ratzeburgh, in his Entomological communication in the Transactions of the Imperial Leopold and Caroline Academy of Sciences, vol. XVII., 1st division, pp. 429, treating on this subject, has proved in the most distinct manner, that the *Hylobius abietis*, Schönh., and the *Curculio pini*, Linn., must be regarded as identical.

decidedly downwards, and is tolerably thick, the antennæ nearly extend to its lip when at rest. On the somewhat anteriorly narrowed thorax are some short yellow hairs on both sides, as well as on the moderately high middle ridge. The wing-cases have several long and short transverse bands, ornamented with small yellow hairs.

The larva which, according to the supposition of Dr. Ratzeburg, belongs to this insect, is thick, fleshy, becoming suddenly diminished at both ends, and it consists of a head and twelve segments, which compose the body. The upper side of the segments appears wrinkled in various contortions and folds. Instead of the three pairs of thoracic feet, there are three pairs of small ones, with from four to six long, brown, fleshy tubercles, furnished with several short hairs. The other part of the under side of the body is distinguished by folds, or if by hairs they are very short. On the upper side is a transverse row of hairs in the middle of each segment, from one spiracle to the other, and generally a long and short one alternately. The oval fold, or space, which appears to be inserted below the segments on the upper side, has no hairs. The colour of the twelve segments is milk-white, the spiracles only appear brown from some very small dots like hairs. The head is reddish-brown, with dark and almost blackish-brown jaws and palpi; only the yellowish divided furrow of the under side of the head is whitish.

This insect is more injurious in its perfect state than as a larva; because its transformation never takes place in young living wood, but only in dead wood, and probably always in stocks of pines and firs.

The female, probably, lays her eggs deep in the root of the tree, and the passages of the larvæ appear to confirm the supposition, as they generally run upwards. The favourite resorts of the beetles are those spots where the pines were felled, where the stocks and unpruned branches lie, although it is found at times, when it has increased very much, in other places, on account of its power of flight. It passes the winter in the felled trees, and is found in spring on the lowest branches of the young stems that are covered with grass and moss. The beetles collect in such places in July and August, at the time of laying their eggs, in great numbers. Of the continuance of the larva state nothing is distinctly known; they seem, however, to pass the winter unchanged.

The perfect insects do not appear every year at the same time; they have been found in extraordinary numbers sometimes in June and July, and sometimes in May, and then again in August. What reason they have for appearing at such different times, we have no means of ascertaining. We may, however, with probability conclude that they have a double brood, like the bark-beetles.

The injury which these beetles commit is very sensibly felt on the felled timber, and even on the growing seedlings, thereby injuring the cultivation of the pine in the vicinity. They do not spare other kinds of plants, having been observed on rhododendrons, azaleas, and alders. They prefer attacking the pine and other trees of that family, selecting those that are just planted and sickly, in which the motion of the sap is more stagnant, and where their attacks are not opposed by such an obstinate resistance of the escape of the resin.

These insects attack both bark and buds. Not only is the bark attacked by them on the trunks and branches, but also on the ramifications of the roots near the surface of the ground, where they are often very dangerously wounded. The wound penetrates through the inner bark to the sap-wood, and is long afterwards known by an ugly, scabby-looking appearance on the bark, occasioned by the issuing of the resinous drops, which become hard in course of time. If the trees are injured by several beetles at the same time, the wounds made by the *Hylobius abietis* may be easily known by their size, as they are often in the form of a bean, as well as by the depth, and by the irregularity of their margin. Young, slender trees of the pine kind are often so much gnawed that they are easily broken down by the wind. When a bud is attacked, if only in the least pierced by the rostrum, it unfolds itself with difficulty, or remains stunted.

The insect is so much on its guard, that as soon as it hears a footstep it withdraws into a secure situation; and when there is the smallest movement of the bushes, the whole brood fall into the grass below, so that only stragglers are found with difficulty on the ground.

Nothing certain is known of the winter abode of the beetles; they probably bury themselves in the loose soil where the pines were felled, because they are found in numbers in the spring in sandy or hollow places.

The Branded Weevil. *Curculio* (*Pissodes*) *notatus*, Hbst.

This insect differs principally from the foregoing in its smaller size, and the almost uniform breadth of its whole body; and (although from very subtle distinctions it has been placed in another genus by new systematists) it is chiefly distinguished by its markings. Its body is three lines long, not including the rostrum, which is only one line long, much thinner than that of the *Hylobius abietis*, and slightly bent downwards. The ground-colour of the insect is reddish-brown, and it may also be discovered, under a moderately magnifying-glass, that the whole body is covered with whitish scales. Four small white dots appear on the thorax in a transverse row, two of which are faint. There are two transverse bars on the wing-cases, the first of which is short, and is placed before the middle, so that it looks like two spots; the other is somewhat beyond the middle, and reaches nearly from one side to the other. These bars are sometimes yellow, and sometimes white. The legs and the whole under side of the body are also covered with white scales. This branded weevil is always found in the train of the foregoing species; and it is seen on trees that are rendered sickly by the former, and generally finishes the destruction, which without it, or others of its kind, such as the different kinds of bark-beetles, would perhaps have been avoided. This weevil is found in very different places: in wood split for fuel, in the young living stems of pines, in the pine cones, and in the bark at the base of full-grown pines. Its abode under the bark of the young pines alone is important; because it can do no injury to the wood split for burning, and the pine cones which it always selects, are on sickly trees growing on poor soils, which would otherwise be useless. Those attacking the young pines are, therefore, the most to be guarded against. There are certainly many circumstances which co-operate in the destruction effected by this beetle. First, it may be occasioned by weather favourable to its increase, which often at the same time causes the plants to become sickly, thus rendering them more exposed to the attacks of the insects; or perhaps there may be some defect in the management of the forest, which under other circumstances would not have been detrimental, but which cannot fail to be attended with serious results in a year when these insects predominate. Planted pines appear to suffer more than those which are self-sown, as after planting, the trees are often in a sickly state, and, indeed, the too great crowding and shading of the trees before planting out, &c. may have some influence.

This weevil at first only feeds on those sickly trees that have been previously attacked by the *H. abietis;* but when this supply fails, it is obliged to have recourse to those that are healthy. Hence it sometimes happens that whole plantations of sound and healthy trees are destroyed, exactly in the same manner that enormous devastations occasioned by the unusual increase of the famous *Hylesinus piniperda* have taken place in certain seasons; an increase which is not without examples among other insects. The branded weevils pierce the bark not only for their food, but also to deposit their eggs in the hole they have bored, and in doing this, the rostrum pierces into the bark as far as to the eyes, and the hole reaches to the innermost part of the inner bark, though seldom into the sapwood. The natural whitish colour of the inner bark turns to a yellowish-white in those places where it has been gnawed. Those wounds that are occasioned by *C. notatus*, look like fine holes made by needles, and are often found in particular spots in numbers beyond belief.

The female beetle, either daily, or at intervals of several days, lays a single egg at a time, which is deposited in the bark, as has been already stated, at least one inch above the root, but generally much higher, and from six to ten days elapse before the egg is hatched.

The first effort of the larva is to gnaw through the bark and inner bark to the wood. To effect this, it forms a channel in this short passage which perfectly resembles the one afterwards seen between the inner bark and the wood. The dust with which this passage is stopped up behind it appears of a reddish-brown: the larva is very active in this performance, and soon commences the greater devastation between the bark and the wood, making passages in the bark as well as in the wood. These passages run lengthways in the tree, either everywhere parallel, near each other, or here and there running into each other at angles. All that is gnawed in this way from the inner bark and the wood, serves the insects for food, and is found as fine dust in the passages. The wider these passages become from the increased growth of the larva, and the thicker the sausage-formed brown and white spotted gnawings appear, which stop up the passage behind the insects, so much the nearer does the insect approach to the completion of the larva state. At last it prepares for pupation, and digs for itself a cavity at the end of its burrow, of an elliptical form, five lines long, two broad, and two deep, which in small trees nearly reaches the pith. The insect does not consume the gnawings which are produced by forming this hollow, they only serve it as a covering during pupation. Here the insect lies quite concealed, first as a larva, then after a longer or shorter time as an upright pupa, its feet turned outwards, and finally, a beetle after an unlimited period, which entirely depends on the state of the weather.

If the beetle is observed coming out, it will be seen that it makes its exit at a circular hole in the bark. This opening is not larger than a small shot-hole; sometimes, when the smaller specimens come out, the hole is so very minute that it can scarcely be conceived how the beetle could proceed from it. No doubt the parts of the creature are softer at this time than afterwards, and can more easily be pressed together. There is also a very great difference among the beetles in point of size. The majority of these holes are close to the roots. Sometimes some are seen under the first tier of branches, and much oftener under the second.

The insect also attacks the pine-cones, and it has been observed that often half, and even three-fourths of all the cones on one tree, have been attacked by larvæ. In general only one maggot is found in each cone, and seldom two or three. Although the beetle is seen flying in spring as well as in autumn, there is in general but one brood in the year; the insect does not pass the winter as a maggot, but as a beetle, and pairing takes place in the first warm days of April.

The female does not lay all her eggs at once, but at long intervals, so that their different development takes place throughout the whole summer.

The beetle does not pass the winter under the bark, but in the chinks of it, as near the inner bark as possible, on young well-grown stems of three or four inches in diameter, and always in that part where the root proceeds from the trunk, sometimes even deep in the earth, but usually above it. The insects are generally in a longitudinal position, the head turned downwards, and quite still. The place of the beetle's abode in the pine is covered with withered leaves or grass. It is difficult to find, as generally but few pass the winter in one stem.

With respect to the application of the means for destroying so dangerous an enemy to the pine and fir tribe, Dr. Ratzeburg observes:—"Let us inquire first into the method of preventing the evil as much as possible, and secondly of setting limits to it as soon as perceived."

First—Although we are frequently visited by the devastations of insects, proceeding from sources which we cannot sufficiently trace, yet we sometimes have an idea of the primitive cause, and can, therefore, act in some measure on it. We have, however, made such advances in the knowledge of the subject, that we have almost lost the fear of the dreaded *Hylesinus piniperda*, and therefore we need not despair of the insect in question.

From the above account of the manner of life of these two most dangerous weevils, it may be seen that they stand, in relation to each other, something in the way of cause and effect.

If *Hylobius abietis* is only seen in moderation, as is the case most years, *Pissodes notatus* is limited in numbers, and indeed is then sometimes rare. When the first, however, is abundant, its companion multiplies fast also, and the trees attacked by them perish. Now, however, the cause of the occasional superabundance of the former has, I believe, been fully ascertained. Places where the stumps of the pines had remained long without being rooted up were attacked by them; while in places where no stumps were to be found, only a few beetles were seen, at least only as many as had wandered from the places that were attacked by them. Also the branches of felled trees which had lain long on the ground appear to have allured the caterpillar. However, the increase of *H. abietis* would not alone have occasioned the destruction of the forests, if the foundation of the disease had not lain in the trees themselves. They were evidently sickly before they sank under the attacks of the beetle, that is, they had grown weakly in the shade, or there had been some fault in the planting; indeed the badness of the soil might alone be sufficient to cause a sickly appearance. It has already often been mentioned that the influence of particular years, such as too great drought, renders trees more liable to be attacked by insects.

We should also first take into consideration if a number of beetles abound during the year in which young plants are transplanted. Secondly, we should pay attention to the health and peculiar treatment of the young trees. And, thirdly, we should watch closely the remaining stumps of the felled trees, under the bark of which the beetle lodges.

Second—If the evil has once befallen the plantation and the young stems are already full of insects, then Nature alone should not be trusted to, with a hope that she will cure herself. Those trees that have been attacked should be destroyed as soon as possible; and the trouble and expense incurred will be repaid by the consequences. Yet even this must not be set about unseasonably. The proper time is when the old beetles have laid their eggs, or when the larvæ and pupæ are lying torpid in the wood; and the trees as soon as they are cut down should be burnt.

Merely rooting up the sickly trees and throwing them away is not sufficient, as the beetle would then make its escape, as is the case with stems that are cut up for fuel. If considerable spaces are made in the plantations, it is better to plant them again than to lose all the trees. Neither ought we to be satisfied with merely cutting down the tree; because many larvæ may lurk in the remaining stump, or at any rate it serves to entice more beetles, which are very eager in their search for diseased wood. An excellent method, and one which cannot be too much praised, is by the use of decoy-trees, for destroying small beetles, particularly the bark-beetles (*Hylesinus piniperda*, *ater* and *angustatus*); the good consequences of which may be easily proved by examining one of these trees, before destroying it. When we set about destroying the insects, we lay every year in April or May some newly cut stems of the pine in an open part of the forest; and in a few hours they are found covered with beetles, particularly so where the stem has been somewhat pressed into the earth. Eichof found this method so effectual, that by it he almost entirely extirpated this insect at the beginning of the year. It is to be understood that this decoy-tree should not be laid too late, and also that it must be destroyed before the brood escapes.

Almost the whole of the numerous family of the long-horned beetle (*Cerambyx*, Linn.) live on wood, and the greater number of them live sometimes singly, and sometimes in great numbers, partly under the bark, and partly in the trunks of the different trees. The observation has been made with these also that they usually attack sickly trees; many of them indeed prefer felled timber for their food, while others take up their abode in mouldering and decayed wood.

The pine and fir tribe, and more particularly the old firs, sometimes sustain the greatest injury.

THE CONJURING BEETLE. *Rhagium (Cerambyx) inquisitor*, Autor.

This beetle is from a half to three-quarters of an inch long, and nearly three lines broad; its antennæ are not quite half the length of the body. The whole insect, with the exception of some spots on the wing-cases and the head, is covered with short, thick, yellowish-grey down; the ground colour is black. The anterior half, viz. the head and thorax, is only about half as broad as the abdomen; and it is also furnished with strong jaws. The eyes are of a longish-round shape, and brown, behind which there is a longish black spot. The thorax both before and behind has pretty deeply marked lines, somewhat prominent towards the middle, and both sides are furnished with a short spine.

The abdomen becomes smaller by degrees towards the end. The wing-cases have a moderately sized elevation on the shoulders towards the outer edge, a tolerably broad reddish band is seen in the middle, on both sides of which, towards the outer edge, there is a black spot. These spots sometimes run into a black band, particularly when the beetle has lost its hair. The legs are of a moderate length. It is generally met with in forests of the pine and fir, in the months of May and June.

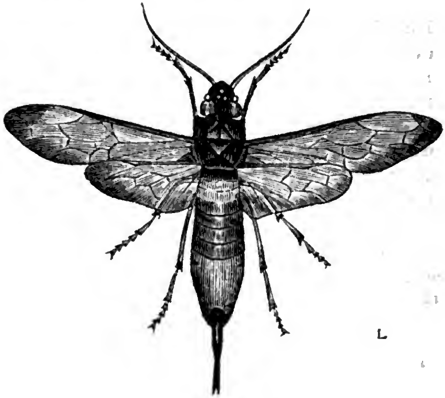
The larva is of a dirtyish-white, thick, longish, and somewhat depressed. Head blackish-brown, the first segment somewhat horny, brownish, and furnished with a few hairs. The pupa is at first yellowish-white, by degrees assuming the colour of the beetle, the perfect form of which is easily perceptible in the pupa. The injury which these beetles occasion is only considerable when there are many sickly trees, occasioned by scraping off the resin, &c. in a fir-forest, which they continually select for the reception of their eggs; or when, as is generally the case, they are found in the train of the bark-beetles. It is only in such cases that these beetles can be reckoned among the more destructive insects.

The methods for lessening their numbers, or for destroying them, are evident from the circumstances related, in which alone they are injurious, and which must therefore be obviated or avoided from the beginning. The thick fat maggots, or woodworms of these insects, are a favourite food for birds, particularly for the woodpecker.

What has been said of this beetle, applies also to the two that are nearly allied to it, viz. *Rhagium mordax* and *Rhagium indagator*, which are principally distinguished from *Rhagium inquisitor* by their size.

THE GREAT SIREX. (*Sirex gigas*, Linn.)

This is a terror-inspiring insect to the common people of Germany, on account of the two points with which the abdomen of the female is furnished; it lives on growing wood, particularly the fir, like the foregoing species, but it much prefers wood fit for building or joinery, that is, felled, and somewhat dried, into which it sometimes bores eight inches deep; therefore such timber should not be allowed to lie in the forest with the bark on. As already mentioned, the sexes are very different in appearance. The female is generally one inch and a half long, sometimes longer or shorter, and has an almost cylindrical body. The head, thorax and abdomen are of the same diameter; the two first are black, with only a yellow spot on each side of the head behind the eyes. The antennæ of the female are more than half, whilst those of the male are nearly the entire length, of the body; they are yellow and many-jointed. The two first and three last segments of the abdomen of the female are yellow, the four middle ones are of a velvety black, the anal end of the body is furnished with a double horny point, two lines long; on the underside of the abdomen, somewhat in the middle, is a long and black ovipositor, lying in a yellow sheath, composed of two semicylindrical pieces, with which it bores holes in the wood for its eggs. The feet are long, thighs black, and the tibiæ and tarsi yellow, the four membranous wings are large with wide cells or meshes, and of a brownish yellow colour. The male is smaller, and without the above-mentioned point having an entirely flat abdomen, which is only black at the base, and on the last segment, the other parts being entirely yellow; the hind feet are black, with yellow rings.



SIREX GIGAS.

The larva is thick, and of a whitish-yellow colour, from one and a half to two inches long, with six true, and no spurious feet; tail-joint thick, ending with a short point.

After pairing, the female bores a hole for each single egg in the bark of the stem of the fir with her long ovipositor. In the seventh week after the eggs are laid the maggot has attained its full size, and then generally buries itself six inches deep in the wood, where it is transformed in a cavity into a pupa, covered with a thin transparent skin. It remains lying in this state a long time, and examples are given of the perfect insect only making its appearance when the wood has been cut up for useful purposes. This insect is therefore never rare in Germany; and even in cities it often makes its appearance from the wood used for fuel, or from timber used for building. The same method of destruction is used for it as for the foregoing insect.

The roots of pines and firs, particularly those of young trees, are principally attacked by the larvæ of the cockchafer; and the trees are thereby destroyed. The best method of annihilating these larvæ has been already described under the head of the may-bug.*

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* In addition to the number of species noticed in the text, and those mentioned in a preceding note as having been introduced by Dr. Ratzeburg into his recently published work upon forest insects, the reader will find a considerable number of others recorded in the article upon the insects found upon the various species of the pine and fir tribe contributed by me to Mr. Loudon's *Arboretum Britannicum*.

THE END.

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